

LEHIGH UNIVERSITY PUBLICATION


UNIVERSITY
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APRIL
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BETHLEHEM, PENNSYLVANIA

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LEHIGH UNIVERSITY

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University Calendar

1955 - 1956

1955

January 3, 8:10 a.m. (Mon.)	Christmas vacation ends
January 10 (Mon.)	Last day for filing applications for degrees to be granted in February
January 15 (Sat.)	Last day of classes for arts seniors taking comprehensive examinations
January 19-22 (Wed.-Sat.)	Comprehensive examinations for arts seniors
January 22 (Sat.)	Last day of classes in Fall Semester
January 24 (Mon.)	Course examinations begin
February 2 (Wed.)	Course examinations end
February 7, 8 (Mon., Tues.)	Registration for Spring Semester
February 9 (Wed.)	Spring Semester instruction begins
February 19 (Sat.)	Last day on which registration for Spring courses will be permitted
April 2 (Sat.)	Mid-Semester reports due
April 2, 1:00 p.m. (Sat.)	Spring vacation begins
April 11, 8:10 a.m. (Mon.)	Spring vacation ends
April 15 (Fri.)	Last day for filing applications for degrees to be conferred in June
May 24 (Tues.)	Last day of classes for arts seniors taking comprehensive examinations
May 31 (Tues.)	Last day of classes in Spring Semester
June 1 (Wed.)	Course examinations begin
June 10 (Fri.)	Course examinations end
June 19 (Sun.)	Baccalaureate Sunday
June 20 (Mon.)	University Day
June 21 (Tues.)	Registration for Summer Session (1st 6 weeks)
June 22 (Wed.)	Summer Session instruction begins (1st 6 weeks)
July 30 (Sat.)	End of Summer Session (1st 6 weeks)
August 1 (Mon.)	Registration for Summer Session (2nd 6 weeks)
August 2 (Tues.)	Summer Session instruction begins (2nd 6 weeks)
August 16 (Tues.)	Post Session ends
September 10 (Sat.)	Last day for filing applications for degrees to be conferred on Founder's Day End of Summer Session (2nd 6 weeks)
September 12, 3:00 p.m. (Mon.)	First Faculty meeting

LEHIGH UNIVERSITY

September 14 (Wed.)	Freshman Week begins
September 16-19 (Fri.-Mon.)	Make-up examinations and special examinations
September 19-21 (Mon.-Wed.)	Registration for Fall Semester
September 22 (Thurs.)	Fall Semester instruction begins
October 3 (Mon.)	Last day on which registration for Fall courses will be permitted
October 9 (Sun.)	Founder's Day
November 17 (Thurs.)	Mid-Semester reports due
November 23, 10 p.m. (Wed.)	Thanksgiving vacation begins
November 28, 8:10 a.m. (Mon.)	Thanksgiving vacation ends
December 20, 10 p.m. (Tues.)	Christmas vacation begins

1956

January 4, 8:10 a.m. (Wed.)	Christmas vacation ends
January 10 (Tues.)	Last day for filing application for degrees to be granted in February
January 14 (Sat.)	Last day of classes for arts seniors taking comprehensive examinations
January 18-21 (Wed.-Sat.)	Comprehensive examinations for arts seniors
January 21 (Sat.)	Last day of classes in Fall Semester
January 23 (Mon.)	Course examinations begin
February 1 (Wed.)	Course examinations end
February 6, 7 (Mon., Tues.)	Registration for Spring Semester
February 8 (Wed.)	Spring Semester instruction begins
February 18 (Sat.)	Last day on which registration for Spring courses will be permitted
March 31, 1:00 p.m. (Sat.)	Spring vacation begins Mid-Semester reports due
April 9, 8:10 a.m. (Mon.)	Spring vacation ends
April 14 (Sat.)	Last day for filing applications for degrees to be conferred in June
May 22 (Tues.)	Last day of classes for arts seniors taking comprehensive examinations
May 29 (Tues.)	Last day of classes in Spring Semester
May 30 (Wed.)	Course examinations begin
June 8 (Fri.)	Course examinations end
June 17 (Sun.)	Baccalaureate Sunday
June 18 (Mon.)	University Day

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- FREDERICK AUGUSTUS ACHEY (1951).....*Research Assistant in Chemistry*
B.S., Franklin & Marshall, 1951; M.S., Lehigh, 1953.
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B.S., Ball State Teachers College, 1942; M.A., 1947.
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B.A., Ohio Wesleyan, 1943; M.A., Columbia, 1951.
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B.A., Arkansas, 1913; M.A., Illinois, 1914; Ph.D., Cornell, 1923.
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A.B., Wesleyan, 1905.
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ing, Head of the Department of Electrical Engineering, Director of
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gineering
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- GOPALKRISHNA UPPINANGADY BHAT (1952)..... *Research Assistant in*
Metallurgy
B.Sc, Banaras Hindu University, 1948; M.S., Lehigh, 1951.
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sics
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- EDGAR MAXWELL BLACKBURN (1953) *Assistant, Military Science and
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B.S. in Chem., University of Vermont, 1950; M.S. in Chem., 1952.
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- DAVID LIANG KUAN CHU (1954)..... *Research Assistant in Chemistry*
B.A., Denison University, 1950.
- WILLIAM BRADFORD CLEMENT (1952)..... *Assistant Professor of Engineering Drawing*
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- JAMES GORE DARRAH (1953)..... *DuPont Fellow in Metallurgy*
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- GUIDO ALDO GUARINO (1954)..... *Instructor in Spanish*
B.S., Columbia, 1949; A.M., 1951.
- SAMUEL LINIAL GULDEN (1953)..... *Instructor in Mathematics and*
B.S., City College of New York, 1949; M.A., Princeton, 1950. *Astronomy*
- GEERHARD HAALJER (1952)..... *Research Assistant in Civil Engineering*
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Education; Counselor, University Counseling Center
B.S., Pennsylvania State Teachers College (Kutztown), 1940; M.Ed., Temple,
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- MARJORIE HALPERN (1952)..... *Graduate Assistant in Mathematics*
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Captain, USAF.
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FACULTY AND STAFF

- GEORGE WALLACE KYTE (1946, 1951)..... *Associate Professor of History*
A.B., California, 1940; M.A., 1941; Ph.D., 1943.
- DONALD CAMPBELL LAMB, JR. (1953)..... *Graduate Assistant in Geology*
B.A., University of Rochester, 1953.
- ROBERT OLIVER LAMBERT (1953)..... *Associate Professor of Military Science and Tactics*
Major, U.S.A.; A.B., Western Maryland, 1941.
- KENNETH WORCESTER LAMSON (1926, 1952) *Associate Professor Emeritus of Mathematics*
A.B., Harvard, 1906; Ph.D., Chicago, 1917.
- *FRED VIAL LARKIN (1912, 1948)..... *Professor Emeritus of Mechanical Engineering*
B.S., Wisconsin, 1906; M.E., 1915; Eng.D., Stevens Institute of Technology, 1948.
- ARTHUR IRVING LARKY (1954) *Research Engineer*
B.S. in E.P., Lehigh, 1952; M.S. E.E., Princeton, 1953.
- VORIS V. LATSHAW (1931, 1947) *Associate Professor of Mathematics*
B.A., Indiana, 1927; A.M., 1928; Ph.D., 1930.
- FRANCIS HAROLD LAXAR (1949)..... *Instructor in Metallurgy*
B.S., Columbia, 1943.
- MARION CANDLER LAZENBY (1946) *Assistant Professor of German*
B.A., Birmingham-Southern, 1930; M.A., Vanderbilt, 1933; Ph.D., Johns Hopkins, 1941.
- WILLIAM BADER LECKONBY (1946)..... *Assistant Professor of Physical Education, Coach of Varsity Football and Golf*
B.S., St. Lawrence, 1939.
- MARVIN CHI-YAO LEE (1954)..... *Instructor in Metallurgy*
B.S., Fu Jen University, 1948; M.S., University of Hawaii, 1951.
- GERALD GRANT LEEMAN (1950)..... *Assistant Professor of Physical Education, Varsity and Freshman Wrestling Coach, Varsity Cross Country Coach, Assistant Track Coach*
B.A., Iowa State Teachers College, 1948.
- JOHN DOUGLAS LEITH (1945, 1947)..... *Associate Dean of Students*
A.B., North Dakota, 1920; A.M., Columbia, 1924.
- FREDERIC HOWARD LEVIEN (1954)..... *Graduate Assistant in Mechanical Engineering*
B.S. in Mech. Engin., University of Missouri, 1951.
- LESTER SAMUEL LEVY (1953)..... *Instructor in Economics*
B.A., Rutgers, 1949; M.A., Cornell, 1951.
- JOSEPH FRANCIS LIBSCH (1946, 1954)..... *Professor of Metallurgy*
B.S., M.S., Massachusetts Institute of Technology, 1940; Sc.D., 1941.
- ANDREW WILLARD LITZENBERGER (1929, 1933)..... *Superintendent of Buildings and Grounds*
Cert. in Architectural Engineering, University of Pennsylvania, 1911.
- ANTONIO MONTELIBANO LOCSIN (1954)..... *Brink Fellow in Civil Engineering*
B.S.C.E., University of the Philippines, 1951.
- MASON RANDOLPH LOGIE (1952)..... *Research Assistant in Chemistry*
B.S., Hobart, 1952.

*Died May 23, 1954.

- ARTHUR LEE LOWE, JR. (1953)..... *Research Assistant in Metallurgy*
B.S., Virginia Polytechnic Institute, 1951.
- HOWARD THEODORE MACFARLAND (1950)..... *Instructor in Electrical Engineering*
B.S. and M.S. in Electrical Engineering, Massachusetts Institute of Technology, 1950.
- JAMES DECKER MACK (1946, 1950) *Librarian*
B.A., Lehigh, 1938; M.A., 1949.
- HARIT VISHNUPRASAD MAJUMDAR (1954) = *Graduate Assistant in Electrical Engineering*
B.Sc. in Engineering, Banaras Hindu University, 1952; D.I.I.Sc. (P.E.), Indian Institute of Science, 1954.
- DONALD GEORGE MANLY (1952).....*Research Assistant in Chemistry*
Sc.B., Brown, 1952.
- RICHARD BENNETT MARGERISON (1953) *Graduate Assistant in Chemistry*
B.S., Lehigh, 1953.
- J. WILLIAM MARR (1954) *Graduate Assistant in Chemistry*
B.S., Virginia Polytechnic Institute, 1953.
- JAMES KINLOCH OGILVIE MARTIN (1953) *Research Assistant in Chemistry*
B.Sc., St. Andrews University, 1953.
- ARCHIE MATHEWS (1954).....*Instructor in Civil Engineering*
B.S. in C.E., University of Massachusetts, 1953; M.S.E., University of Michigan, 1954.
- JOSEPH SIMON MATHIAS (1951)..... *Research Assistant in Metallurgical Engineering*
A.B., University of Bombay, 1946; B.S., 1944; M.S., 1948; M.Met.E., University of California, 1951.
- JOSEPH ABELE MAURER (1947, 1953).....*Associate Professor of Classical Languages*
B.A., Moravian, 1932; M.A., Lehigh, 1936; Ph.D., Pennsylvania, 1948.
- LOUIS MAUS, JR. (1948, 1951)..... *Assistant Professor of Chemical Engineering*
B.S. in Ch.E., Lehigh, 1947; M.S., 1948, Ph.D., 1951.
- JOHN WALTER MAXWELL, JR. (1927, 1946)*Bursar and Purchasing Agent*
B.S., Lehigh, 1926.
- JOHN STEWART MCCALLUM, JR. (1953) *Graduate Assistant in Geology*
A.B., University of Pennsylvania, 1953.
- JOSEPH BRENDAN MCFADDEN (1948, 1950)..... *Assistant Professor of B.A., St. Joseph's (New Brunswick), 1941; M.A., Syracuse, 1948. Journalism*
- JAMES WILLARD MCGEADY (1950, 1952) .. *Assistant Director of Admissions*
B.A., Lehigh, 1950.
- JAMES ALAN MCLENNAN, JR. (1948, 1954) *Assistant Professor of Physics*
A.B., Harvard, 1948; M.S., Lehigh, 1950; Ph.D., 1952.
- MURRAY BURNS MCPHERSON (1947, 1951) .. *Associate Professor of Civil Engineering*
B.S., Bucknell, 1942; M.S., State University of Iowa, 1947; C.E., Bucknell University, 1952.

FACULTY AND STAFF

- ALLEN HENRY MEITZLER (1951) *Graduate Assistant in Physics*
B.S., Muhlenberg, 1951; M.S., Lehigh, 1953.
- ARCHIE ROSCOE MILLER (1922, 1946) *Professor of Electrical Engineering*
B.S. in E.E., Illinois, 1918; M.S., Lehigh, 1925.
- EUGENE HERBERT MILLER (1954) *Visiting Professor in International Relations*
B.S., Ursinus, 1933; M.A., University of Pennsylvania, 1934; Ph.D., Clark, 1940.
- HOWARD C. MILLER (1953) *Graduate Assistant in English*
A.B., Union, 1953.
- JOHN CLARK MILLER (1952, 1953) *Research Assistant in Chemistry*
B.S., Lehigh, 1952.
- THEODORE MILLON (1954) *Assistant Professor of Psychology*
B.S., C.C.N.Y., 1950; M.A., 1951; Ph.D., University of Connecticut, 1954.
- EDWARD THOMAS MISIASZEK (1954) *Instructor in Civil Engineering*
B.C.E., Clarkson Tech., 1952; M.C.E., 1954.
- PAUL PETER MISIKEVICH (1953) ... *Assistant, Military Science and Tactics*
Sergeant First Class, U.S.A.
- SAMUEL HAROLD MISSIMER (1950, 1952) *Assistant Director of Admissions*
B.A., Lehigh, 1950.
- DOUGLAS EWART MODE (1940, 1953) ... *Professor of Electrical Engineering*
B.S. in E.E., Pennsylvania, 1935; M.S. in E.E., 1940; Ph.D., 1947.
- MOHAMED NAEEM MOHAMED (1954) *Research Assistant in Chemistry*
B.A., American University, 1946; B.S., North Carolina State College, 1954.
- ALBERT CHARLES MOLTER (1953) *Professor and Head of the Department of Military Science and Tactics*
Colonel, U.S.A.; B.S., Norwich, 1928.
- CARL LELAND MOORE (1948, 1953) *Assistant Professor of Accounting*
A.B., Bucknell, 1943; M.A., Pittsburgh, 1948; C.P.A., Pennsylvania, 1952.
- CAROLYN EUGENIA MOORE (1951) *Research Assistant in Chemistry*
B.A., Bucknell, 1950.
- CHARLES JOHN MORAVEC (1937, 1946) *University News Editor*
B.S., Albright, 1937.
- ROBERT PATTISON MORE (1916, 1950) *Professor of German, Head, of the Department of German, Dean of the College of Arts and Science, Director of the Curriculum in Arts and Science*
B.A., Lehigh, 1910; M.A., Harvard, 1913.
- E. ROBINS MORGAN (1935, 1952) *Placement Advisor Emeritus*
M.E., Lehigh, 1903.
- HERMAN C. MOUWEN (1954) *Research Assistant in Chemical Engineering*
B.S. Ch.E., Lehigh, 1954.
- ROBERT DONALD MUHL (1953) *Graduate Assistant in Physics*
Geophysical Engineer, Colorado School of Mines, 1953.
- EDGAR KIRTON MUHLHAUSEN (1946, 1949) ... *Assistant Professor of Civil Engineering*
B.S. in C.E., Lehigh, 1942; M.S., 1948.

- RAFFAELE FRANCESCO MURACA (1948, 1951)..... *Assistant Professor of*
B.S. in Chem., Lehigh, 1944; M.S., 1947; Ph.D., 1950. *Chemistry*
- WILLIAM JAMES MURPHY (1952) *Instructor in Metallurgy*
B.S. in Met.E., Wayne, 1949; M.S. in Met.E., Lehigh, 1951.
- FRANK EVANS MYERS (1946).....*Professor of Physics, Head of the Depart-*
ment of Physics, Director of the Curriculum in Engineering Physics
B.A., Reed, 1927; M.S., New York University, 1930; Ph.D., 1934.
- RAYMOND REEVER MYERS (1950, 1953) *Research Assistant Professor in*
Chemistry
B.A., Lehigh, 1941; M.S., University of Tennessee, 1942; Ph.D., Lehigh, 1952.
- HAROLD L. NAYLOR (1952)*Assistant Professor of Air Science and*
Captain, USAF. *Tactics*
- BENJAMIN MATTHIAS NEAD (1947, 1949) *Instructor in English*
B.A., Lehigh, 1947; M.A., 1950.
- JOSEPH SHIVE NEIDIG (1949)..... *Part-time Instructor in Education*
Ph.B., Muhlenberg, 1924; M.A., Pennsylvania, 1928.
- HARVEY ALEXANDER NEVILLE (1927, 1949)..... *Professor of Chemistry,*
Director of the Lehigh Institute of Research, Dean of the Graduate
School
A.B., Randolph-Macon, 1918; M.A., Princeton, 1920; Ph.D., 1921; LLD.,
Randolph-Macon, 1952.
- WILLIAM ARTHUR NEVILLE (1949, 1951)..... *Instructor in English*
A.B., University of New Hampshire, 1949; M.A., Lehigh, 1952.
- GERALD HENRY NEWMAN (1954) *Graduate Assistant in Chemistry*
B.A., Hofstra, 1954.
- SATORU NIIMOTO (1954).....*Research Assistant in Civil Engineering*
B.S., University of Hawaii, 1951.
- ROBERT BAYLESS NORRIS (1950, 1953).....*Associate Professor of Education,*
Assistant to Director of Adult Education Program and Summer Session
B.S. in Ed., Mansfield State Teachers College, 1939; M.Ed., Harvard, 1946;
Ed.D., Columbia, 1951.
- JOHN HUTCHESON OGBURN (1895, 1939) ... *Professor Emeritus of*
C.E., Vanderbilt, 1892. *Mathematics and Astronomy*
- FRANCIS CLYDE OGLESBY (1954)..... *Graduate Assistant in Mathematics*
A.B., Dickinson College, 1954.
- WALTER FRANKLIN OLD (1953).....*Graduate Assistant in Mathematics and*
B.A., Hofstra, 1953. *Astronomy*
- RAYMOND GEORGE O'NEIL (1952)..... *Instructor in Accounting*
B.A., University of Massachusetts, 1949; M.B.A., University of Maryland, 1952.
- BRADFORD BRECKENRIDGE OWEN (1945, 1948).....*Associate Professor of*
B.A., Williams, 1934; M.A., 1936; Ph.D., Harvard, 1940. *Biology*
- RUTH ELMINA COSGROVE PACE (1948, 1949)..... *Circulation Librarian*
B.A., Moravian College for Women, 1941; B.S. in L.S., Carnegie Library School,
1942; M.A., Lehigh, 1951.
- ANTHONY PACKER (1946) *Assistant Professor of Physical Education,*
B.S., St. Lawrence, 1938. *Coach of Varsity Basketball and Baseball*

FACULTY AND STAFF

- PAUL COLUMN PARIS (1953).....*Research Assistant in Civil Engineering and Mechanics*
B.S. in E.M., University of Michigan, 1953.
- DAVID MAXWELL PARKE (1952).....*Instructor in Mechanical Engineering*
B.S. in M.E., Lehigh, 1948; M.S. in M.E., 1949.
- BASIL WALDO PARKER (1940, 1954).....*Professor of Biology, Head of the Department of Biology*
S.B., Massachusetts Institute of Technology, 1933; A.M., Harvard, 1935; Ph.D., Massachusetts Institute of Technology, 1939.
- PRESTON PARR, JR. (1949, 1951)....*Assistant Director, Institute of Research*
B.S. in Ch.E., Lehigh, 1943; M.S., 1944.
- JOSEPH WALTER PASQUALI (1954).....*Graduate Assistant in Chemical Engineering*
B.S. in Ch.E., Lehigh, 1954.
- JOHN A. PATTERSON (1953)....*Associate Professor of Military Science and Tactics*
Major, U.S.A.; B.S., University of California, 1941.
- HARRY GORDON PAYROW (1916, 1950) . *Associate Professor Emeritus of Sanitary Engineering*
B.S. in C.E., Tufts, 1907.
- ALBERT GORDON PETERKIN III (1948)... *Assistant Professor of Education*
B.A., Pennsylvania, 1936; M.A., Harvard, 1938; Ed.D., Columbia, 1954.
- ARTHUR EVERETT PITCHER (1938, 1948).....*Professor of Mathematics*
A.B., Western Reserve, 1932; A.M., Harvard, 1933; Ph.D., 1935.
- LEONARD T. POLOMSKI (1953).....*Assistant, Air Science and Tactics*
Master Sergeant, USAF.
- GEORGE PRESTON POSTON (1954).....*Assistant Professor of Air Science*
Captain, U.S.A.
- ELWOOD L. PRESTWOOD (1954).....*Part-time Instructor in Education*
A.B., Columbia University, 1929; M.A., Lehigh University, 1939; Ed.D., Columbia University, 1951.
- SAMUEL VAN ORDEN PRICHARD, JR. (1954).....*Instructor in Speech*
B.A., University of Redlands, 1949; M.A., 1949.
- FRANCIS JOSEPH QUIRK (1950, 1953).....*Professor of Fine Arts and Head of the Department of Fine Arts*
Dipl., Rhode Island School of Design, 1929.
- EDWARD GEORGE RANKEY (1954).....*Assistant Cataloger*
B.A. in History, Moravian College, 1940; B.S. in Library Science, Syracuse University, 1949.
- SATYABRATA RAY (1954).....*Research Assistant in Geology*
B.Sc., Presidency College (India), 1948; M.Sc., 1950.
- GEORGE EMIL RAYNOR (1931, 1946)....*Professor of Mathematics, Head of the Department of Mathematics and Astronomy*
B.S., Washington, 1918; M.A., Princeton, 1920; Ph.D., 1923.
- ANGUS MACDONALD REES (1952).....*Manager of Publications*
B.S., Boston University, 1949.
- HOWARD ROLAND REITER (1911, 1941).....*Professor Emeritus of Physical Education*
A.B., Princeton, 1898; M.A., 1900.
- JOSEPH H. RENO (1947, 1949)....*Assistant Professor of Physical Education, Team Physician*
M.D., Temple University, 1941.

LEHIGH UNIVERSITY

- FREDERICK EUGENE RESSLER (1952) *Assistant to the Registrar*
A.B., Lehigh, 1952.
- JOSEPH BENSON REYNOLDS (1907, 1948) *Professor Emeritus of*
Mathematics and Theoretical Mechanics
B.A., Lehigh, 1907; M.A., 1910; Ph.D., Moravian, 1919.
- ALFRED RICHARDSON, JR. (1953) *Graduate Assistant in Chemistry*
B.S. in Chem., Rutgers, 1953.
- WALLACE JAMES RICHARDSON (1952) *Associate Professor of Industrial*
B.S., U.S. Naval Academy, 1941; M.S. in I.E., Purdue, 1948. *Engineering*
- ROGER HARRY RICHMAN (1954) *Allegheny-Ludlum Fellow in*
Metallurgy
B.S. in Met. Eng., New Mexico Institute of Mining and Technology, 1950.
- EDWIN WILLIAM RICKENBACH (1953) *Instructor in Air Science*
Master Sergeant, U.S.A.
- JACK RUSSELL RIDGE (1954) *Graduate Assistant in Physics*
B.S., Moravian College, 1953.
- ALBERT AUGUSTUS RIGHTS (1933, 1943) *Assistant Professor of English*
A.B., Maine, 1927; A.M., Harvard, 1931.
- EDGAR HEISLER RILEY (1926, 1931) *Associate Professor of English*
A.B., Cornell, 1915; Ph.D., 1925.
- ROBERT FRANCIS RILEY (1919, 1947) *Assistant Order Librarian*
- ALLAN RUSSELL RITCHIE (1953) *Graduate Assistant in Civil Engineering*
B.S. in C.E., Drexel, 1953. *and Mechanics*
- HOPE THOMAS MARTIN RITTER, JR. (1946, 1948) *Instructor in Biology*
A.B., Cornell, 1943; M.S., Lehigh, 1947.
- FREDERICK ROBBINS (1953) *Research Assistant in Chemistry*
B.A., Lafayette, 1949.
- ALFRED ROESLI (1951) *Research Assistant in Civil Engineering*
C.E., Swiss Institute Technology (Zurich), 1946.
- WILLIAM KENNETH ROHWEDDER (1954) *Graduate Assistant in*
B.S., Lehigh, 1954. *Chemistry*
- ARTHUR JOSEPH ROMANELLI (1954) *Instructor in Civil Engineering*
B.S., Northeastern University, 1950.
- HELEN GENEVIEVE RYAN (1917) *Secretary to the President*
- JOHN DONALD RYAN (1952, 1954) *Assistant Professor of Geology*
B.A., Lehigh, 1943; M.S., 1948; Ph.D., Johns Hopkins, 1952.
- PERCY LEE SADLER (1946) *Professor of Physical Education, Director of*
the Division of Athletics and Physical Education
Brig. Gen., Inf., U.S.A., Ret.
- SABRI SAMI (1954) *Assistant Professor of Engineering Mechanics*
B.S., Cairo University, 1943; M.S., University of Illinois, 1951; Ph.D., 1953.
- STEPHEN SAWRUK (1950) *Research Assistant in Chemistry*
B.S., Lehigh, 1950; M.S., Lehigh, 1952.

FACULTY AND STAFF

- RAYMOND BURKERT SAWYER (1946)..... *Associate Professor of Physics*
Ph.B., Ripon, 1921; M.S., Wisconsin, 1925; Ph.D., Chicago, 1930.
- JOSEPH ARTHUR SCHATZ (1952).....*Instructor in Mathematics*
B.S. in E.E., Virginia Polytechnic Institute, 1947; Ph.D., Brown, 1952.
- WILLIAM HEATON SCHEMPF (1947, 1950).... *Associate Professor of Music*
and Director of the Music Department
Mus.B., Wisconsin, 1939; Mus.M., Rochester, 1942.
- WILLIAM CARL SCHIEVE (1951).....*Graduate Assistant in Physics*
B.A., Reed, 1951.
- WALLACE ALBERT SCHLEGEL (1954).... *Graduate Assistant in Mechanical*
B.S. in Ag. Eng., Penn State, 1950. *Engineering*
- DONALD WALTER SCHMOYER (1946, 1949).....*Accountant*
B.S. in Bus. Adm., Lehigh, 1944.
- CHARLES H. SCHNEIDER (1951).....*Research Assistant in Chemistry*
B.A., University of Delaware, 1942.
- JOHN RUSSELL SCHUG (1954)..... *Graduate Assistant in English*
A.B., Muhlenberg College, 1952.
- CONSTANCE ELIZABETH SCHULZ (1952)....*Research Assistant in Chemistry*
B.A., Bryn Mawr College, 1952.
- ERNST BERNHARD SCHULZ (1927, 1946)*Professor of Political Science*
B.S., Michigan, 1920; M.A., 1921; Ph.D., 1927.
- FREDERICK WILLIAM SCHUTZ, JR. (1952)....*Research Assistant Professor*
of Civil Engineering
B.S. in C.E., Alabama Polytechnic Institute, 1947; M.S. in C.E., University of Illinois, 1950; Ph.D. in C.E., 1952.
- ELI SCHWARTZ (1954).....*Assistant Professor of Finance*
B.S., University of Denver, 1943; M.A., University of Connecticut, 1948; Ph.D., Brown University, 1952.
- RAMON CARLFRED SCOTT (1954)..... *Graduate Assistant in Mathematics*
B.A., American International College, 1953; M.A., University of Massachusetts, 1954.
- WALTER JAMES SCOTT, JR. (1952)*Research Assistant in Physics*
B.A., Swarthmore College, 1941.
- CHARLES AUGUSTUS SEIDLE (1948, 1952).....*Director of Admissions*
B.A., Pittsburgh, 1931; M.A., Columbia, 1936; Ed.D., 1948.
- EDITH AMANDA SEIFERT (1923, 1947)*Cashier*
- EARL JAMES SERFASS (1936, 1952)*Professor of Chemistry, Head of*
Department of Chemistry and Director of the Curriculum in Chemistry
B.S. in Ch.E., Lehigh, 1933; M.S., 1935; Ph.D., 1938.
- JONATHAN BURKE SEVERS (1927, 1951)....*Professor of English, Head of*
the Department of English
A.B., Rutgers, 1925; A.M., Princeton, 1927; Ph.D., Yale, 1935.
- ARCHIBALD NORBERT SHERBOURNE (1954).....*Research Assistant in Civil*
B.Bc., London University, 1953. *Engineering*
- WILLIAM SHERIDAN (1911, 1954)..... *Assistant Professor Emeritus of*
Physical Education

- FRANK ROBERT SHOAF (1952) ... *Research Assistant in Psychology*
A.B., Dickinson College, 1952.
- CLARENCE ALBERT SHOOK (1930, 1946) ... *Professor of Mathematics*
A.B., Western Reserve, 1916; A.M., Harvard, 1918; Ph.D., Johns Hopkins, 1923.
- PAUL EDWARD SHORT (1938, 1946) ... *Assistant Professor of Physical Education; Assistant Director and Business Manager of Athletics*
B.S. in Bus. Adm., Lehigh, 1934.
- JOHN T. SHUMAN (1954) ... *Part-time Instructor in Education*
Ph.B., Dickinson College, 1928; M.S., Pennsylvania State University, 1934; D.Ed., 1944.
- REYNOLD ALLEN SHUNK (1949)..... *Research Assistant in Physics*
B.S. in Eng. Physics, Montana State College, 1949; M.S., Lehigh, 1951.
- CHARLES WELLINGTON SIMMONS (1928, 1940)..... *Professor of Chemical Engineering*
B.Sc., Queens (Ontario), 1920; M.S., Lehigh, 1928.
- ARTHUR ROBERT SIMPSON (1954)..... *Assistant Professor of Military Science*
B.S., Colorado A & M, 1943; Captain U.S.A.
- JOHN DAVID SKEWIS (1954)..... *Graduate Assistant in Chemistry*
B.S., Penn State, 1954.
- *LLOYD LEROY SMAIL (1926, 1929) ... *Professor Emeritus of Mathematics*
A.B., University of Washington, 1911; A.M., 1912; Ph.D., Columbia, 1913.
- ARNOLD MCCOLLUM SMALL (1954) ... *Assistant Professor of Psychology*
A.B., San Diego State College, 1951; M.S., University of Wisconsin, 1953; Ph.D., 1954.
- EARL KENNETH SMILEY (1934, 1945).... *Vice-President; Secretary of Board of Trustees*
A.B., Bowdoin, 1921; M.A., Lehigh, 1935; L.H.D., Moravian, 1947; LL.D., Waynesburg, 1952.
- ALEXIS SMISLOVA (1949, 1954)..... *Assistant Professor of Civil Engineering*
B.S. in C.E., Roberts College (Istanbul), 1943; M.S., Lehigh, 1951.
- JEROME EARL SMITH (1954)..... *Research Assistant in Civil Engineering*
B.S. (C.E.) University of Washington, 1954.
- STANLEY FRED SMITH (1952) ... *Graduate Assistant in Physics*
B.S., St. Lawrence, 1952.
- JUDSON GRAY SMULL (1919, 1950) *Associate Professor Emeritus of Chemistry*
B.S., in Chem., Lehigh, 1906; M.S., 1921.
- MAX DONALD SNIDER (1946)..... *Assistant Professor of Economics*
B.S., Illinois, 1936; M.S., 1937; M.B.A., Stanford, 1941.
- RAYMOND HORNING SNYDER (1950, 1952)..... *Associate Professor of Sanitary Engineering*
B.S. in C.E., Lehigh, 1938.
- RAFAEL ARCHANGEL SOTO (1925, 1954) ... *Associate Professor Emeritus of Romance Languages*
B.S., Illinois, 1912; B.A., 1915; M.A., 1917.
- THOMAS ANTHONY JOSEPH SPARTA (1952, 1953).... *Research Assistant in Chemistry*
B.A., Lafayette, 1951.
- WILBER DEVILLA BERNHART SPATZ (1946, 1954) ... *Associate Professor of Physics*
B.S., Lafayette, 1930; M.S., Purdue, 1934; Ph.D., New York University, 1943.

*Died January 26, 1955.

FACULTY AND STAFF

- HERBERT JENNINGS SPENCER (1953).....*Graduate Assistant in Biology*
B.A., Lehigh, 1953.
- KENNETH REY STAHL (1954).....*Graduate Assistant in Economics*
B.S., Lehigh, 1954.
- HOMER STALKER (1953).....*Assistant, Military Science and Tactics*
Master Sergeant, U.S.A.
- ALBERT CHARLES STEIN (1953).....*Graduate Assistant in Chemistry*
B.S., Muhlenberg, 1953.
- ALBERT MILLER STOCK (1953).....*Graduate Assistant in Chemistry*
A.B., Gettysburg, 1953.
- RICHARD RHODE STORROW (1950).....*Graduate Assistant in Chemistry*
B.A., Lehigh, 1950; M.S., Lehigh, 1952.
- WILLIAM VITUS STOSCHECK (1954)....*Instructor in Engineering Drawing*
Mechanical Engineer, State Engineering School Gleiwitz, 1940.
- BRADLEY STOUGHTON (1923, 1944).....*Professor Emeritus of Metallurgy*
Ph.B., Yale, 1893; B.S., Massachusetts Institute of Technology, 1896; Eng.D.,
Lehigh, 1944.
- ROBERT DANIEL STOUT (1939, 1950).....*Professor of Metallurgical*
Engineering
B.S., Pennsylvania State, 1935; M.S., Lehigh, 1941; Ph.D., 1944.
- CARL FERDINAND STRAUCH (1938, 1953).....*Professor of English*
A.B., Muhlenberg, 1930; M.A., Lehigh, 1934; Ph.D., Yale, 1946.
- GEORGE STRAUSS (1952).....*Research Assistant in Chemistry*
B.Sc., University of London, 1950.
- HOWARD SAMUEL STRAUSSER, JR. (1950). *Assistant Professor of Mechanics*
B.S. in C.E., Virginia Military Institute, 1942; M.S., Johns Hopkins
University, 1950.
- MILTON CALEB STUART (1926, 1952).....*Professor of Mechanical*
B.S. in M.E., Pennsylvania, 1909; M.E., 1924. *Engineering*
- ROBERT LAMB STUBBINGS (1949, 1953)....*Research Assistant Professor of*
B.S., Lehigh, 1941; M.S., 1946; Ph.D., 1949. *Chemistry*
- ALFRED WALTER STUBNER (1954).....*Research Assistant in Mechanical*
B.S. M.E., Lehigh, 1953. *Engineering*
- HALE SUTHERLAND (1930, 1952) *Professor Emeritus of Civil Engineering*
A.B., Harvard, 1906; S.B., Massachusetts Institute of Technology, 1911.
- JOHN MCFALL SYLVESTER (1946).....*Lecturer on Plant Management*
Graduate, U. S. Naval Academy, 1911.
- IVAN JACKSON TAYLOR (1953).....*Instruments Associate in Civil*
Engineering and Mechanics
- JAMES HOWARD TAYLOR, JR. (1953).....*Research Assistant in Chemistry*
B.S., Virginia Polytechnic Institute, 1950; M.S., Lehigh, 1952.
- LOYD CHAMBERLIN TAYLOR, JR. (1951)... *Graduate Assistant in History*
B.A., Lehigh, 1949; M.A., 1951.
- †RICHARD WIRTH TAYLOR (1952, 1954)....*Assistant Professor of Political*
B.A., University of Illinois, 1947; M.A., 1948; Ph.D., 1950. *Science*

†Resigned Feb. 1, 1955.

- ROBERT SAXTON TAYLOR (1950)..... *Assistant Librarian*
A.B., Cornell, 1940.
- ROBERT SAYRE TAYLOR, JR. (1950)..... *Legal Counsel*
B.A., Lehigh, 1925; LL.B., University of Pennsylvania, 1928.
- EVERETT ANDERSON TEAL (1945) *Director of Placement, Counseling and Reading Services*
B.S., Ball State Teachers College, 1932; M.A., Columbia, 1941.
- ARCHIE LOUIS TENGZELIUS (1953)..... *Research Assistant in Chemistry*
B.S., Muhlenberg College, 1952.
- JOSEPH TENO (1952)..... *Instructor in Electrical Engineering*
B.S. in E.E., Lehigh, 1951; M.S. in E.E., 1952.
- GEORGE ALLEN TERRELL (1953) *Assistant, Military Science and Tactics*
Master Sergeant, U.S.A.
- EARLE GORDON THOMAS III (1954)..... *Instructor in Air Science*
First Lieutenant, U.S.A.
- HAROLD PRESCOTT THOMAS (1932)..... *Professor of Education, Head of the Department of Education, Director of the General College Division, Director of the Summer Session, Director of the Adult Education Program*
B.S., Colgate, 1920; Ed.M., Harvard, 1925; Ed.D., 1932.
- STANLEY JUDSON THOMAS (1923, 1928)..... *Professor of Bacteriology*
B.S., Lafayette, 1912; M.S., Lehigh, 1913; M.A., 1915; Ph.D., Pennsylvania, 1928.
- LOUIS FELSINGER THOMPSON (1950, 1951)..... *Instructor in English*
A.B., Columbia, 1948; M.A., Lehigh, 1952.
- BRUNO THURLIMANN (1952)..... *Assistant Professor of Civil Engineering*
Dipl., Swiss Federal Institute of Technology, 1946; Ph.D., Lehigh, 1951.
- WILLIAM P. TOLLINGER (1955)..... *Part-time Instructor in Education*
B.A., Swarthmore, 1927; M.A., University of Pennsylvania, 1930.
- PETER RALPH TOSCANO (1953)..... *Instructor in Economics*
A.A., George Washington, 1948; M.A., University of Chicago, 1951.
- FRANCIS JOHN TREMBLEY (1928, 1949)..... *Professor of Ecology*
B.S., Hobart, 1928; M.S., Lehigh, 1931; Ph.D., Pennsylvania, 1934.
- JOHN SCHRADER TREMPER (1939, 1952)..... *Associate Professor of German*
A.B., Colgate, 1928; M.A., Cornell, 1932; Ph.D., 1938.
- ROCCO JOHN TRESOLINI (1949, 1953)..... *Associate Professor of Political Science*
A.B., Hartwick, 1942; M.A., Syracuse, 1947; Ph.D., 1949.
- JOHN HENRY URBAN (1954)..... *Assistant Professor of Economics*
B.S., Purdue, 1948; M.S., 1949; Ph.D., 1951.
- RALPH NEWCOMB VANARNAM (1928, 1942)..... *Assistant Professor of Mathematics and Astronomy*
E.E., Cornell, 1926; M.S., 1927.
- JACK VANDERRYN (1951)..... *Research Assistant in Chemistry*
B.A., Lehigh, 1951; M.S., 1952.
- JAMES RICHARD VAUGHN (1952)..... *Research Assistant in Bacteriology*
B.S., Muhlenberg, 1952.

FACULTY AND STAFF

- WILLIAM WALLACE VIRGIN, JR. (1954).....*Graduate Assistant in Geology*
B.A., University of New Hampshire, 1952.
- JAMES HAROLD WAGNER (1949, 1951)..... *Registrar*
B.A., Gettysburg, 1947; M.A., University of Pennsylvania, 1950.
- WILLIAM COMSTOCK WALKER (1946, 1953)..*Research Assistant Professor*
B.S. in Ch.E., Lehigh, 1943; M.S., 1944; Ph.D., 1946. *of Chemistry*
- CARL KELLEY WALTERS, JR. (1953)..... *Assistant, Military Science and*
Master Sergeant, U.S.A. *Tactics*
- SHERWOOD GEORGE WALTERS (1950, 1954)..... *Assistant Professor of*
A.B., Western Maryland College, 1949; M.S., Columbia, 1950; M.B.A., Colum-
bia, 1953. *Economics*
- BEATRICE SEMMEL WALTZ (1954).....*Assistant Manager of Publications*
B.S. in Education, Wheelock College, 1952.
- KOON-SANG WAN (1954) .. *Assistant Professor of Engineering Mechanics*
B.S., Chiao-Tung University, 1946; M.S., Harvard University, 1949; Ph.D., Poly.
Inst. of Brooklyn, 1951.
- THOMAS W. WATKINS (1949)..... *Part-time Instructor in Education*
A.B., Dickinson, 1931; M.A., Lehigh, 1942.
- KENNETH ARTHUR WEILER (1954).....*Graduate Assistant in Geology*
B.S., Bates College, 1953.
- ULRICH WERNER WEISSTEIN (1954) *Instructor in German*
M.A. in Letters, Indiana University, 1953; Ph.D., 1954.
- LEONARD ANDREW WENZEL (1951) *Assistant Professor of Chemical*
B.S., Penn State, 1943; M.S., University of Michigan, 1948; Ph.D., 1949. *Engineering*
- KARL LEROY WERKHEISER (1950).....*Assistant Accountant*
B.S., Rider College, 1950.
- JAMES EDWARD WERT (1954)..... *Assistant Professor of Accounting*
B.S., Lebanon Valley College, 1948; M.B.A., University of Pennsylvania, 1951;
Ph.D., Ohio State University, 1954.
- ROBERT WEST (1954) *Assistant Professor of Chemistry*
B.A., Cornell, 1950; M.A., Harvard, 1952; Ph.D., 1954.
- DONALD BINGHAM WHEELER, JR. (1947)..*Assistant Professor of Physics*
B.S. in Eng. Phys., Lehigh, 1938; Ph.D., California Institute of Technology, 1947.
- MARTIN DEWEY WHITAKER (1946)..... *President*
A.B., Wake Forest, 1927; M.A., North Carolina, 1930; Ph.D., New York Uni-
versity, 1935; LL.D., Lafayette, 1946; Sc.D., Moravian, 1947; Sc.D., Wake
Forest, 1947; LL.D., Rutgers, 1948.
- LAWRENCE WHITCOMB (1930, 1939).....*Associate Professor of Geology*
Ph.B., Brown, 1922; A.M., Princeton, 1928; Ph.D., 1930.
- JAMES JOSEPH WHITE (1953).....*Assistant, Military Science and Tactics*
Master Sergeant, U.S.A.
- MAXWELL WILLIAM WHITE (1953) *Research Assistant in Civil*
B.E., N.S.W. University of Technology, 1952. *Engineering and Mechanics*
- WILLIAM BECKLER WHITE (1946, 1948)..... *Instructor in English*
A.B., Hampden-Sydney, 1940; M.A., Lehigh, 1942.

- WILLIAM GORDON WHITTON (1950) *Assistant Professor of Physical Education, Assistant Football Coach, Varsity Track Coach, Freshman Basketball Coach*
B.A., St. Lawrence University, 1947.
- ALBERT WILANSKY (1948, 1952).....*Associate Professor of Mathematics*
B.A., Dalhousie, 1941; B.S., 1942; Ph.D., Brown, 1947.
- BRADFORD WILLARD (1939)*Professor of Geology Head of the Department of Geology*
B.A., Lehigh, 1921; A.M., Harvard, 1922; Ph.D., 1923.
- SAMUEL STERLING WILLEY (1954)..... *Instructor in Air Science*
B.A., Marshall College, 1949; First Lieutenant, U.S.A.
- ALBERT CHARLES WILLIAMS (1951)..... *Graduate Assistant in Physics*
B.S., Lafayette, 1950; M.S., Lehigh, 1952.
- ALEXANDER WILLIAMS, JR. (1954).....*Reference Librarian*
A.B., Harvard, 1945; M.S. in L.S., Syracuse University, 1950; M.A., Ohio State University, 1954.
- MARY WILLIAMS (1954).....*Research Assistant in Psychology*
B.A., Cedar Crest, 1954.
- ROBERT W. WILSON (1951)..... *Assistant, Air Science and Tactics*
Master Sergeant, USAF.
- EDWIN LEWIS WOISARD (1951)..... *Graduate Assistant in Physics*
B.S., Drew, 1950; M.S., Lehigh, 1952.
- PHILIP B. WOODROOFE (1951, 1953).....*Director of Residence Halls*
- DAVID LYNDON WOODS (1954).....*Instructor in Speech*
A.B., San Jose State, 1952; M.A., Stanford, 1954.
- HORACE WETHERILL WRIGHT (1921, 1950) *Professor Emeritus of Latin*
A.B., Wisconsin, 1908; Ph.D., Pennsylvania, 1917.
- TI YEN (1954)..... *Instructor in Mathematics*
B.S. in M.E., Chiao-Tung University, 1944; M.S. in M.E., University of Illinois, 1949; A.M. in Mathematics, 1950; Ph.D., 1954.
- GEORGE JAMISON YOUNG (1950, 1954).....*Instructor in Chemistry*
B.S., Rensselaer Polytechnic Institute, 1950; M.S., Lehigh, 1952; Ph.D., 1954.
- YUNG-FANG YU (1952)*Research Assistant in Chemistry*
B.S., National Chekiang, University of China, 1948.
- ALBERT CHARLES ZETTMAYER (1941, 1950)..... *Professor of Chemistry*
B.S. in Ch.E., Lehigh, 1936; M.S., 1938; Ph.D., Massachusetts Institute of Technology, 1940.
- HOWARD J. B. ZIEGLER (1947, 1953).....*Professor of Philosophy, Head of the Department of Philosophy*
B.A., Franklin and Marshall, 1930; B.D., Theological Seminary of the Reformed Church in U.S., 1933; S.T.M., Lutheran Theological Seminary at Philadelphia, 1941; Ph.D., Columbia, 1950.

FELLOWS AND SCHOLARS

- JOHN THOMAS BALLASS *Linde Air Products Fellow in Metallurgy*
B.S., Missouri School of Mines, 1951; M.S., 1952.
- CHARLES ALLEN BLOOD, JR. *Althouse Fellow in Chemistry*
B.S., University of Vermont, 1950; M.S., 1952.
- JOSEPH CHESTER BORICHEWSKY *Gotsball Scholar in Civil Engineering*
B.S., Lehigh, 1954.
- ANTHONY JAMES BUDDEN *King George VI Memorial Fellow in Mechanical Engineering*
H.N.C., Bristol College of Technology.
- RICHARD NEIL COBB *University Scholar in Mathematics*
A.B., Bowdoin College, 1932; A.M., Harvard University, 1933.
- HERMAN EDWARD COLLIER, JR. *Socony-Vacuum Fellow in Chemistry*
B.S., Randolph-Macon College, 1950; M.S., Lehigh, 1952.
- JAMES GORE DARRAH *DuPont Fellow in Metallurgy*
B.Met. E., Rensselaer Polytechnic Institute, 1952; M.Met.E., 1953.
- JEAN HENRI DECROIX *Hornor Fellow in Metallurgy*
Ing. Civil des Mines, Paris, 1954.
- WILLIAM EDWIN DONAHUE *Althouse Fellow in Chemistry*
A.B., Bradley University, 1947; M.S., Washington State College, 1951.
- JACK WINDREM ENTERLINE *University Scholar in Industrial Engineering*
B.S., Pennsylvania State University, 1952.
- WILLIAM JOSEPH GALLAGHER *Westinghouse Fellow in Mechanical Engineering*
B.S., Drexel Institute of Technology, 1953.
- YASUZI HIRONAKA *University Scholar in International Relations*
B.A., Kwansei Gakuin University, 1951.
- SALVATORE MICHAEL IMPERIAL *Thorne Fellow in Biology*
B.S., Muhlenberg, 1953.
- WILLIAM WOODING KENAWELL *Parkhurst Fellow in History*
A.B., Franklin and Marshall College, 1953.
- KENNETH BARRETT KNOWLTON *New Jersey Zinc Co. Fellow in Geology*
A.B., Colgate University, 1954.
- FRANK LEONARD KERCHINSKY *University Scholar in Chemical Engineering*
B.S., Virginia Polytechnic Institute, 1952.
- ANTONIO MONTELIBANO LOCSIN *Brink Fellow in Civil Engineering*
B.S., University of the Philippines, 1951.
- JOHN ANDREW MACNAB *University Scholar in Industrial Engineering*
B.S., Lehigh, 1954.
- ALLEN HENRY MEITZLER *Hood Fellow in Physics*
B.S., Muhlenberg College, 1951; M.S., Lehigh, 1953.
- PIERRE JACQUES MIDOL-MONNET *Gotsball Scholar in Civil Engineering*
Baccalaureat, Institution des Chartreux, 1947.
- HILLARD CRAIG MILLER *Baldwin Fellow in Physics*
A.B., Lehigh University, 1954.

LEHIGH UNIVERSITY

- JOHN CLARK MILLER *Sinclair Fellow in Chemistry*
B.S., Lehigh, 1952.
- SATYABRATA RAY *New Jersey Zinc Co. Fellow in Geology*
B.S., Presidency College (India), 1948; M.S., 1950.
- ROGER HARRY RICHMAN *Allegheny-Ludlum Fellow in Metallurgy*
B.S., New Mexico Institute of Mining and Technology, 1950.
- THOMAS ANTHONY JOSEPH SPARTA *Howard Flint Fellow in Chemistry*
B.A., Lafayette College, 1951.
- JOHN LEWIS STORCH *Gotsball Scholar in Civil Engineering*
B.S., Bucknell University, 1953.
- RICHARD RHODE STORROW *Student Chemistry Foundation Fellow*
A.B., Lehigh, 1950; M.S., 1952.
- JOSHUA WILSON STOUT *Weirton Steel Fellow in Chemistry Engineering*
B.S., Lehigh, 1954.
- THEODORE ALFRED TERRY *DuPont Fellow in Mechanical Engineering*
B.S., Drexel Institute of Technology, 1950; M.S., Lehigh, 1951.
- JOHN PUSHEGY THOMAS *Packard Fellow in Biology*
B.S., Wagner College, 1951; M.S., Lehigh, 1952.
- FERNANDO LUIS TORRES *Byllesby Fellow in Civil Engineering*
Survey, Facultad de Ciencial Matematicas, U.N.L., Argentina, 1949; C.E., 1953.
- ANTONIO SANTIAGO VILLANUEVA *Byllesby Fellow in Civil Engineering*
B.S.C.E., Mapua Institute of Technology, 1952.

SUMMER SESSIONS

(In addition to members of the regular staff)

- HOWARD O. ARMSTRONG *Dean of Boys, Anderson High School,*
Anderson, Indiana
- E. CARLTON ABBOTT *Superintendent of Schools,*
Lansdowne, Pennsylvania
- FAY C. BARTLETT *Assistant Director of Physical Education,*
Lehigh University, Bethlehem, Pennsylvania
- NELSON F. BEELER *Associate Professor of Science, State University*
Teachers College at Potsdam, New York
- RUTH BURG *Reading Consultant, Allentown School District,*
Allentown, Pennsylvania
- JOHN S. CARTWRIGHT *Superintendent of Schools, Allentown,*
Pennsylvania
- GEORGE A. EICHLER *Superintendent of Schools, Northampton,*
Pennsylvania
- GLADYS FISH *Special Education Adviser, Pennsylvania Department*
of Public Instruction, Harrisburg, Pennsylvania
- GEORGE H. GILBERT *Principal, Lower Merion Senior High*
School, Ardmore, Pennsylvania
- J. HERBERT KINSINGER *Director of Industrial Education, Reading,*
Pennsylvania

SUMMER SESSIONS

MARY MAHAN	<i>Demonstrator in Art, Binney and Smith, New York, New York</i>
JAMES E. NANCARROW	<i>Principal, Upper Darby Township Senior High School, Upper Darby, Pennsylvania</i>
JOSEPH S. NEIDIG	<i>Superintendent of Schools, Quakertown, Pennsylvania</i>
JANE GRAY SMITH	<i>Adviser, School Libraries, Department of Public Instruction, Harrisburg, Pennsylvania</i>
CORRINE SNOW	<i>Music Coordinator, East Orange, New Jersey</i>
J. MARICE STRATTAN	<i>Superintendent of Schools, Tredyffrin-Easttown School District, Berwyn, Pennsylvania</i>
THOMAS W. WATKINS	<i>Supervising Principal, Coopersburg, Pennsylvania</i>
ELIZARETH K. ZIMMERLI	<i>Chairman Department of Health and Physical Education, Lock Haven State Teachers College, Lock Haven, Pennsylvania</i>

SUPERVISORS OF STUDENT TEACHING IN COOPERATING HIGH SCHOOLS

ORRIN W. BACHERT	<i>Science, Nitschmann Junior High School, Bethlehem</i>
EARL J. BAUMAN	<i>Social Studies, Fountain Hill High School, Bethlehem</i>
PAUL E. G. MILLER	<i>Science, Fountain Hill High School, Bethlehem</i>
EUGENE G. NAGY	<i>Science, Liberty High School, Bethlehem</i>
ADAM E. SHEKLETSKI	<i>Science, Nazareth Area Joint High School, Nazareth</i>
HAROLD F. SHUNK	<i>Social Studies, Nitschmann Junior High School, Bethlehem</i>
JOHN F. SPIRK	<i>Social Studies, Fountain Hill High School, Bethlehem</i>
ROBERT L. STAUFFER	<i>Science, Allentown High School, Allentown</i>
MYRON STETTLER	<i>Science, Liberty High School, Bethlehem</i>

STANDING COMMITTEES OF THE FACULTY

(In each case the chairman is named first. The term of each elected member expires in June of the year given in parentheses after his name. The President and Vice President are *ex officio* members of all committees.)

ADMISSIONS: C. A. Seidle, W. H. Congdon, J. H. Wagner (*ex officio*); A. Butts (1955), H. J. B. Ziegler (1956), R. M. Davis (1957), A. G. Peterkin (1958), B. B. Owen (1959), R. D. Billinger (1960).

ADVANCED STANDINGS: J. H. Wagner, C. A. Seidle (*ex officio*); R. D. Stout (1955), E. H. Riley (1956), H. J. B. Ziegler (1957).

DISCIPLINE: W. H. Congdon (*ex officio*), R. T. Gallagher (1955), B. W. Parker (1956), and two student members.

EDUCATIONAL POLICY: E. C. Bratt (1955), J. B. Hartman (1956), G. J. Christensen (1957), E. D. Amstutz (*vice H. R. Gault, on leave*) (1958); W. H. Congdon, C. E. Allen, L. V. Bewley, R. P. More, H. A. Neville (*ex officio*); J. H. Wagner, Secretary (*ex officio*).

HONORARY DEGREES: G. D. Harmon (1955), E. L. Crum (1956), H. M. Diamond (1957), E. C. Bratt (1958), A. J. Barthold (1959).

INSPECTION TRIPS: L. Whitcomb (1955), A. W. Brune (1956), A. F. Gould (1957), J. V. D. Eppes (1958).

PETITIONS: J. H. Wagner (*ex officio*), R. J. Tresolini (1954), A. J. Barthold (1955), R. E. Kolm (1955), D. E. Mode (1956), M. D. Snider (1956).

PUBLICATIONS, BOARD OF: B. C. Hayes, J. B. McFadden, R. F. Herrick (*ex officio*), and three student members.

ROSTER: J. H. Wagner (*ex officio*), A. G. Peterkin (1955), J. A. Maurer (1956), C. W. Curtis (1957).

STANDING OF STUDENTS: W. H. Congdon, C. E. Allen, L. V. Bewley, A. Butts, W. J. Eney, A. S. Foust, R. T. Gallagher, A. F. Gould, J. B. Hartman, R. P. More, F. E. Myers, C. A. Seidle, E. J. Serfass, H. P. Thomas, J. H. Wagner (*all members ex officio*).

STUDENT ACTIVITIES: B. C. Hayes (*ex officio*), R. M. Davis (1955), and three student members.

STUDENT CLUB FINANCES: B. C. Hayes (*ex officio*), E. K. Muhlhausen (1955), and three student members.

SUMMER SESSION: H. P. Thomas, C. A. Seidle, J. H. Wagner (*ex officio*), M. C. Lazenby (1955), J. E. Jacobi (1956), H. V. Anderson (1957), R. D. Stout (1958).

SPECIAL STANDING COMMITTEES
OF THE UNIVERSITY

ATHLETIC ELIGIBILITY: P. L. Sadler (*ex officio*), J. D. Leith (1955), H. D. Hotchkiss (1956), G. W. Kyte (1957), C. D. Jensen (1958).

CATALOG: R. F. Herrick, A. M. Rees, C. E. Allen, L. V. Bewley, W. H. Congdon, R. P. More, H. A. Neville.

CHAPEL: R. E. Fuessle, W. H. Congdon (*ex officiiis*), C. E. Allen, H. J. B. Ziegler, R. J. Emrich; 3 alumni; T. E. Butterfield, Jr., F. J. Pearson, W. L. Estes, Jr.; 3 students; F. J. Warnecke, Jr., R. W. Shaffer, G. V. Potter.

DEAN'S WARD: W. H. Congdon, C. E. Allen, L. V. Bewley, B. C. Hayes, J. D. Leith, R. P. More, H. A. Neville.

EXECUTIVE COMMITTEE OF THE GRADUATE FACULTY: H. A. Neville (*ex officio*), J. B. Hartman (1955) W. L. Jenkins (1956), H. M. Diamond (1957), R. D. Stout (1958).

FELLOWSHIPS AND GRADUATE SCHOLARSHIPS: H. A. Neville, W. L. Jenkins.

FORMAL UNIVERSITY EXERCISES: P. L. Sadler, R. F. Herrick, J. D. Leith, A. C. Molter, S. J. Thomas.

FRESHMAN WEEK: J. D. Leith, R. E. Fuessle, A. Ford, C. O. Keck, E. H. Riley, C. A. Seidle, E. A. Teal, S. J. Thomas.

HOUSE COMMITTEE DROWN MEMORIAL HALL: B. C. Hayes (*ex officio*), and two student members: L. Peters, R. Haltenhoff.

INSTITUTE OF RESEARCH: H. A. Neville (*ex officio*), L. V. Bewley (1955), R. B. Cowin (1955), J. F. Libsch (1956), S. J. Thomas (1956).

LIBRARY: J. D. Mack (*ex officio*), C. W. Curtis (1955), R. M. Davis (1956), A. Grunbaum (1957), J. J. Karakash (1958).

MUSIC: W. H. Schempff, R. F. Herrick, C. A. Shook.

NOMINATIONS: H. M. Diamond, H. P. Thomas, J. B. Hartman

PLACEMENT: E. A. Teal, W. H. Congdon (*ex officiiis*), H. M. Diamond (1955), H. P. Thomas (1956).

PROFESSIONAL ENGINEERING DEGREES: L. V. Bewley (*ex officio*) and curriculum director concerned.

"BOSEY" REITER CUP: W. H. Congdon, P. J. Franz, R. E. Fuessle.

LEHIGH UNIVERSITY

RESIDENCE HALLS: P. J. Woodroofe (*ex officio*), J. V. D. Eppes (1955), W. J. Richardson (1956), S. B. Ewing (1957), P. Parr (1958), J. W. Maxwell (1959).

ALFRED NOBLE ROBINSON AWARD: W. J. Eney (1955), R. B. Cowin (1956), E. W. Glick (1957), C. E. Allen, R. P. More, H. A. Neville (*ex officio*).

SAFETY AND PREVENTIVE MAINTENANCE: T. E. Jackson, R. E. Heiland, L. A. Wenzel, C. O. Keck.

SCHOLARSHIPS AND LOANS: W. H. Congdon, P. J. Franz, F. J. Trembley.

STUDENT APPRAISAL OF INSTRUCTORS AND COURSES: G. J. Christensen (1955), C. A. Seidle (1956), J. A. Maurer (*vice H. R. Gault, on leave*) (1957), J. E. Jacobi (1958).

STUDENT CONCERTS-LECTURES: C. J. Moravec, W. H. Schempf, C. A. Shook.

WILLIAMS SENIOR PRIZES: J. B. Severs, F. A. Bradford, H. B. Davis, A. Ford, G. D. Harmon, H. J. B. Ziegler.

Lehigh University

Lehigh University is a non-denominational, private institution comprising the College of Arts and Science, the College of Business Administration, the College of Engineering, the Graduate School, and the Institute of Research. Its offering of the baccalaureate degree is limited to men although men and women are admitted to the Graduate School, the Summer Session, and the Adult Education Program.

Its 26 buildings are located on a 180 acre campus on South Mountain above the City of Bethlehem, Pennsylvania, a site situated approximately halfway between New York City and Harrisburg. A field house, gymnasium, and playing fields on the north side of the city supplement the University's athletic and recreational facilities.

Supplementing the formal academic program is an extensive program of extra-curricular activities, in all of which students have the assistance of competent faculty advisers.

Lehigh is distinctly a university with a purpose. This purpose is a heritage from its founder, the Honorable Asa Packer, industrialist and philanthropist.

Beginning life as a poor farm boy in Connecticut Asa Packer moved to Pennsylvania as a youth and became one of America's pioneer captains of industry. He recognized and developed the great natural resources of that richly endowed section of Pennsylvania known as the Lehigh Valley.

Looking back from the peak of his career Mr. Packer saw clearly how much easier his tasks would have been and how much fuller the fruits of his labor if he had been fortified in youth with a background of training in the arts and natural sciences. Looking forward with penetrating vision he foresaw the great industrial development that was then just beginning. He realized that the training he lacked was to become more and more essential in the years to come.

Originally the founder had in mind a school primarily technical, catering to the youth of the Lehigh Valley. However, as the details of the project were worked out by Judge Packer and his educational advisers, the scope of the educational services contemplated were greatly broadened. They foresaw the complex

social, economic, and technical problems which the future would bring and the need for service and leadership in these areas.

Thus it was that in 1865 Lehigh University was founded to provide young men with a sound basis for successful living, in the fullest sense of the phrase, and to insure leadership for the complex business and industrial civilization of the future.

During his lifetime and by bequest Judge Packer gave Lehigh over three million dollars including land, buildings and endowment. The generosity of the Packer family and other friends of Lehigh, the distinguished faculty originally assembled, and the prominence of early alumni firmly established the reputation of Lehigh in college education, and the young university took its place proudly among older and larger institutions.

The new institution, which opened its doors to young men from the country at large in 1866, was given the character of a small university. From the very beginning Lehigh combined in a unique fashion the traditional American college of liberal arts, the continental university, and the new technical institute of university rank.

The endowment fund of the University now exceeds ten million dollars. The value of equipment, buildings, and grounds is over thirteen million dollars.

Lehigh continues to base its program on the premise that an education for successful living must combine the acquisition of knowledge and skills fundamental in the professions with courses designed to broaden the vision and to enrich the personal life of the individual. Therefore at Lehigh requirements for graduation include studies preparatory to a career, a generous number of courses to acquaint the student with the nature and problems of the world in which he lives, and opportunities to develop himself as an individual.

The organization of Lehigh as a small university contributes to the goal of meeting individual needs by enabling students enrolled in one college to pursue in other undergraduate divisions those studies for which they are qualified and from which they can best profit.

It is also important to note that students may move from one curriculum to another. For instance, a freshman may discover that his first choice was ill-founded. After consultation and investiga-

tion he is permitted to transfer to a curriculum more suited to his interests and abilities.

A comprehensive student advisory system assures that a student will seek and obtain advice in planning for his future career. The services of the officers and departments concerned with advising students are provided on a compulsory and voluntary basis so that when help is needed, it is available.

Lehigh Students have ample opportunity to discuss with qualified and sympathetic advisers problems related to courses of study and problems of a personal nature. (See "Placement, Counseling, and Testing Services" on page 329).

Lehigh University is located in Bethlehem, Pennsylvania, approximately 60 miles north of Philadelphia and 90 miles west of New York City, in the center of the cultural East and in the heart of the industrial production of the Middle Atlantic states.

It was no mere chance that Lehigh was placed on the slope of Old South Mountain. When Judge Packer selected a large tract of land near the banks of the Lehigh River, he knew he was establishing the new university at the very doors of the mighty industries and the historical institutions of the Atlantic seaboard. Bethlehem was at the gateway to westward expansion by railroad and highway. It was (and is) a city, which could serve admirably as a "college town" — providing a bustling industrial community and historic cultural background as laboratories for students.

Settled in 1740 by Moravians Bethlehem is rich in historic traditions with picturesque homes and well-kept gardens. Numbered among its historic places of interest is the Bell House erected in 1745. The bell served the settlers as a call to worship as well as warning the fire or Indians. Colonial Hall, erected in 1748, was used during the Revolutionary War as a hospital for wounded soldiers of the Continental Army.

Each spring Bethlehem is the mecca for thousands of music-lovers from far and near, who come to hear the famous Bach Choir in Packer Memorial Church on the Lehigh Campus.

With a population of about 60,000 Bethlehem is a city of modern commercial and industrial importance. But the 180-acre campus of Lehigh on a hillside on the south side of the Lehigh river ensures the residential character of the University.

Admission Requirements

The enrollment of Lehigh University is strictly limited by action of its board of trustees, with a resulting limitation in the number of candidates who can be admitted each year to the several divisions of the University.

In the selective procedure necessitated by this limitation, the University, through its Office of Admissions, takes into account a number of criteria which are believed to have some individual validity and in combination a high degree of validity in predicting probable success in college work.

(1) HIGH SCHOOL UNITS

The sixteen courses required as entrance credit represent the quantitative equivalent of the usual four-year secondary school program and include certain prescribed subjects and sufficient electives to make up the following totals:

For the College of Arts and Science—

	<i>Courses</i>
English	4
Foreign Language	2
Elementary and Intermediate Algebra.....	1½
Plane Geometry	1
Electives	7½
	<hr/> 16

For the College of Business Administration—

	<i>Courses</i>
English	4
Elementary and Intermediate Algebra.....	1½
Plane Geometry	1
Electives*	9½
	<hr/> 16

For the College of Engineering—

	<i>Courses</i>
English	4
Elementary and Intermediate Algebra.....	1½
Plane Geometry	1
Plane Trigonometry and Logarithms.....	½
Advanced Algebra or Solid Geometry.....	½
	<i>(Recommended but not required)</i>
Electives	8½
	<hr/> 16

The electives may be offered in any subject studied under standard conditions in an accredited secondary school. However, it is recommended that in addition to the above minimum subject

matter requirements all candidates include as many courses in science, history, mathematics, and language as their programs and schools will permit.

(2) QUALITY OF WORK

The quality of the candidate's work will be judged primarily by his rank or relative average grade in his class. Consideration will be given also to the extent to which he has made grades distinctly higher than the minimum passing grade; to evidence of improvement or deterioration in quality of record as he has progressed through secondary school; to his relative success or failure in the particular subjects which he proposes to continue in college; and to the comments and recommendations of his principal or headmaster.

(3) ENTRANCE EXAMINATIONS

All candidates for admission to the freshman class at Lehigh University are required to write entrance tests prepared and administered by the *College Entrance Examination Board*.

Each applicant is required to write a full series of tests: *Morning Program*: Scholastic Aptitude Test; *Afternoon Program*: English Composition Achievement Test and two additional tests selected by the candidate in consultation with his school adviser.

Candidates for the College of Arts and Science and for the College of Business Administration are requested to write a language test and a science, mathematics, or social studies test for the additional afternoon tests.

Candidates for the College of Engineering are requested to write the advanced mathematics test and a science test for the additional afternoon tests.

Lehigh recommends the January and March dates. A candidate may write morning and afternoon tests on the same date or the Scholastic Aptitude Test on one date and the afternoon achievement tests at a later date. If satisfactory for the candidate a recommended procedure is to write the Scholastic Aptitude Test in January and the three afternoon achievement tests in March.

Whenever through illness or other excusable cause the candidate has been prevented from taking the regular College Board tests, he may request permission from the Director of Admissions to take special examinations at the University Testing Center.

Information and application forms for the tests should be secured from the *College Entrance Examination Board* at one of the following addresses (whichever is closer to the candidate's home or school): *P. O. Box 592, Princeton, New Jersey*, or *P. O. Box 9896 Los Feliz Station, Los Angeles 27, California*.

The candidate is responsible for requesting that his test scores be sent to Lehigh—either by indicating Lehigh on his College Board application blank or, if he failed to do this, by special request to the College Board office. In addition to requesting College Board scores, the candidate must submit an application for admission to the freshman class at Lehigh.

(4) OTHER CRITERIA AND INTERVIEWS

Information about other qualifications of candidates is obtained from principals, headmasters, and counselors. Such information relates to the candidate's health, emotional stability, intellectual motivation, social adjustment, participation in school activities, and established habits of industry and dependability.

Normally the officers of admission conduct personal interviews with all candidates at the University or at the candidates' secondary schools. Where distance makes this impossible, interviews are arranged with Lehigh alumni or other qualified persons in the candidate's community. The University reserves the right to require any candidate for admission to present himself for an interview and to base the selection of candidates in part upon the appraisals obtained through such interviews.

Each candidate is urged to visit Lehigh whenever possible so that he may see the University and talk personally with an officer of admission. An appointment should be made in advance of the visit.

Interviews are scheduled on weekdays between 9 and 11:30 a.m. and from 1:30 to 4:30 p.m. and on Saturday mornings from 8:30 to noon. The Office of Admissions is closed Sundays, national holidays, Saturday afternoon during the school year, and all day Saturday during the summer months.

A particularly good time for a candidate and his parents to visit Lehigh is during the summer between the junior and senior years in secondary school. If an applicant has not visited Lehigh prior to his senior year, he should make every effort to schedule an inter-

view in the fall so that he will have an opportunity to see the University and to make serious plans for his college education before he becomes too pre-occupied with activities of the senior year.

Bethlehem is easily reached by automobile, train, bus, or plane. It is served by the Lehigh Valley Railroad (New York to Buffalo) and the Reading System from Philadelphia.

Admission Procedure

ADMISSION TO THE FRESHMAN CLASS

A candidate for admission to the freshman class should secure from the Office of Admissions an application blank and should submit this early in his last year of preparation for college. First consideration is given to applications received prior to *March 1*.

On the application for admission the candidate is asked to indicate his proposed major field of study at Lehigh. Each candidate is urged to read this Catalog or the *Undergraduate Announcement* thoroughly and carefully so that he will be familiar with the programs and opportunities at Lehigh before he indicates his proposed field of study.

He should arrange with his school adviser to register for morning and afternoon tests administered by the College Entrance Examination Board. It is recommended that he write the Scholastic Aptitude Test in January and the three required afternoon achievement tests in March or both morning and afternoon achievement tests in March. Although Lehigh will accept scores from any of the College Board testing dates, a candidate who writes tests in January and March has a better opportunity for consideration than one writing tests at a later date.

The candidate should also arrange for a personal interview.

Most important of all he should maintain a good academic record—particularly during his last year of preparation for college. He should work hard to develop good study habits which will assure a good record in secondary school and will give him a good start in his freshman year in college.

ADVANCED STANDING FROM SECONDARY SCHOOLS

A few private and public secondary schools now offer truly advanced courses for limited numbers of selected students. If a candidate has completed, or expects to complete, such a course in an approved secondary school, he may establish advanced standing by taking an anticipatory examination in the particular subject.

This privilege is granted only on written request to the Director of Admissions not later than June of the year the student plans to enter college.

The examinations are given at the University at times scheduled by the University. A fee of \$5 is charged for each such examination.

Exceptions to this method of establishing advanced standing from secondary schools are made only when a particular school and Lehigh University have agreed to accept well recommended students with advanced standing for specified courses. The school is expected to take the initiative in approaching the University for such an understanding.

ADVANCED STANDING FROM ANOTHER COLLEGE

Candidates for admission by transfer from other institutions may be admitted with advanced standing subject to the enrollment limitations of the several divisions of the University. Such candidates must have met the entrance requirements (other than examinations) prescribed for undergraduates at Lehigh.

A candidate who has studied at another college prior to applying for admission to Lehigh will be considered on the basis of the quality of his record at that college. A candidate who has been dropped from another college for disciplinary reasons or for poor scholarship or who is not in good standing at his former college is not eligible for admission to Lehigh University.

A student who is planning to transfer to Lehigh University should so arrange his work in college that he will cover as many as possible of the subjects of the freshman and sophomore years of the curriculum he selects.

A student who desires to transfer to Lehigh University from another university, college, or junior college must submit an application for admission (on a special transfer form) and an official transcript of his academic record at each college he has attended.

Such a transcript must include a complete list of all courses taken, a list of entrance credits accepted for admission, and a statement of honorable dismissal. A copy of the catalog of each college previously attended should be sent to the Office of Admissions at the time the transcript is forwarded.

A candidate who has attended more than one university, college, or junior college must present a record from each institution. Failure to submit a complete record of former academic experience will result in cancellation of admission or registration.

ACCEPTANCE OF ADMISSION AND DEPOSIT

When a candidate's preliminary credentials are complete and he has been offered formal admission to Lehigh University, he will be asked to notify the Director of Admissions of his acceptance of the offer of admission by making a deposit of \$50 to hold a place for him in the limited enrollment. This deposit is not an additional fee but is applied toward tuition charges for the first semester. However, the deposit is forfeited in case of failure to enroll for the specified semester.

Early offers of admission for the freshman class entering in September are sent in March following receipt of January College Board scores and preliminary secondary school records through the first semester of the senior year. Normally acceptable candidates who write both morning and afternoon tests in March may expect to be notified after the middle of April.

Lehigh does not admit a freshman class in February. However, exceptions may be made for veterans or other more mature students who are unable to complete entrance requirements the preceding September and do not wish to wait until the following regular class is admitted.

VACCINATION REQUIREMENTS

Under the laws of the Commonwealth of Pennsylvania small-pox vaccination is required of all college students. A certificate is accepted for this requirement when the vaccination has been performed within three years of the time of enrollment, the vaccination has resulted in a true vaccina (take), and the scar gives evidence of a recent vaccina.

Since vaccinations are performed at the University and the reactions are read by the method recommended by the United

States Public Health Service, new students are advised to defer vaccination until they enroll.

Undergraduate Fees

The tuition fee for undergraduates carrying fifteen semester hours of work or more is \$400.00 per semester in the College of Engineering and \$362.50 per semester in the College of Arts and Science, the College of Business Administration, and the General College Division. A student regularly enrolled in any of the undergraduate divisions of the University who registers for fewer than fifteen hours of work will pay either \$30.00 for each semester hour carried* or the regular tuition fee for the division in which he is enrolled, whichever amount is lower.

The tuition charge is comprehensive, there being no additional fees for athletics, health service, library, student activities, or student concerts-lectures. In addition, there are no matriculation, graduation, or laboratory fees.

MILITARY DEPOSITS. A deposit of \$25.00 is made by each student taking courses in military or air science and tactics. This deposit is refunded when the government property issued to the student is returned.

CHEMISTRY BREAKAGE. Students taking chemistry laboratory courses are required to reimburse the University for returnable equipment broken or otherwise damaged and for all chemicals used in excess of reasonable amounts. To cover possible charges of this nature, all students registering for laboratory courses in chemistry purchase coupon books costing \$5.00, the unused portions of which are redeemed.

EXAMINATION FEES. Students who for satisfactory reasons absent themselves from final examinations will be allowed, upon petition, to take make-up examinations without payment of any examination fee. A fee of \$5.00 is charged for any examination subsequent to the first regular final or make-up examination allowed upon petition in any course. This regulation applies to the psychological and placement examinations required of new students if taken at some time other than that scheduled.

*In computing tuition charges on the semester-hour basis, English 0 and Mathematics 0 are considered three-hour courses.

A fee of \$5.00 is charged for anticipatory examinations taken by students to establish advanced standing on the basis of work completed in secondary schools. (*See page 48*).

SHOP AND SURVEYING COURSES. A three-week shop course for Industrial and Mechanical Engineering, a six-week surveying course for Civil Engineering, and a three-week surveying course for Mining Engineering are required during the summer between the freshman and sophomore years. A two-week mine surveying course is required at the end of the sophomore year in Mining Engineering. A tuition charge is made for the shop course which is given in Bethlehem through the Department of Mechanical Engineering. The surveying courses are conducted at camps under the auspices of the Departments of Civil Engineering and Mining Engineering. The tuition charge for all of these courses is the regular summer rate of \$22 per credit hour.

LATE REGISTRATION FEES. The penalty for procuring a registration ticket after the time specified by the Registrar shall be \$10.00. A student who does not complete his registration within three days after the date on his registration ticket is subject to a penalty of \$10.00. No registration will be accepted later than the tenth day of instruction in a regular semester or the fifth day of instruction in any summer term.

LATE PRE-REGISTRATION FEE. The penalty for a late pre-registration or a change in pre-registration is \$10.00. This will be waived for cause upon the recommendation of the curriculum director or dean concerned.

CHANGE-OF-ROSTER-FEE. Having once registered in any semester, a student may not add or drop any course except on the recommendation of the director of his curriculum. There will be a \$5.00 change-of-roster fee for each such change unless it is waived by the curriculum director or college dean.

REFUNDS. In the event that a student withdraws from the University after the payment of tuition, he is entitled to receive a refund of his total tuition less \$50.00 and less a deduction of two per cent of the total tuition paid for each day of instruction completed, computed from the first day of instruction in the semester.

A graduate or adult education or summer session student who formally withdraws from the University is entitled to receive a

refund of his total tuition less \$5.00 for each credit hour for which he is registered and less a deduction for each day of regular instruction of two per cent* of the total tuition paid, computed from the first day of instruction in the semester.

In the event of the death of a student or his involuntary induction into the armed forces, tuition will be refunded in proportion to the fraction of the semester remaining at the time of his death or induction.

No student who is suspended or expelled from the University shall be entitled to any refunds.

No refunds will be made to any student for any reduction in his schedule after the tenth day of instruction in a regular semester or the corresponding date in a summer session.

A minimum of 10 days is normally required to process refund checks.

Estimate of Expenses for the College Year

Items of personal expense are dependent upon each student's personal habits and circumstances. There are certain basic expenses, however, which must be met by all students. An *estimate* of those expenses is listed below.

	<i>College of Arts and Science and Business Administration</i>		<i>College of Engineering‡</i>	
	<i>Minimum</i>	<i>Average</i>	<i>Minimum</i>	<i>Average</i>
Tuition	\$ 725	\$ 725	\$ 800	\$ 800
Books and Supplies.....	60	75	120	135
Room	150	225	150	225
Subsistence	475	550	475	550
Total.....	\$1410	\$1575	\$1545	\$1710

(Note: Students taking military or air science are required to make a \$25 deposit which is refundable at the end of the school year.)

*This rate is four per cent during the summer session.

‡Excluding summer sessions (see page 51)

Books, stationery, and drawing instruments may be purchased at the Supply Bureau in the Alumni Memorial Building.

Students are not required to eat in the University Cafeteria and subsistence is payable on a meal by meal basis. For this reason the subsistence estimate will vary according to the needs and tastes of the individual.

Living Quarters and Board

RESIDENCE HALLS

Five permanent residence halls and three temporary structures, located on campus, house approximately 1050 students.

All freshmen are required to live in the residence halls. Exceptions to this rule are made for students who live at home or with relatives or maintain their own homes in the local area.

Upperclass counselors are appointed in the residence halls to work primarily with the freshmen. These selected students are members of the sections to which they are assigned, and they have all the privileges and responsibilities shared by other members. As counselors, appointed by the president of the University, they have assumed certain immediate responsibilities for the general and academic welfare of the individual freshmen, and they serve under the direction of one of the associate deans of students.

Each student in the residence halls is provided with a bed, mattress, pillow, chest of drawers, desk, and chairs. Residents must supply desk lamps, blankets, and quilts. Students may supply their own bed linen and towels and make their own arrangements to have these laundered *or* they may subscribe to a linen service which provides clean bed linen and towels each week. The present charge for this service is \$13.50 a semester.

Personal laundry is handled by the student on an individual basis. Some students prefer to mail their laundry home in special laundry cases. Others use the laundry service made available to men in residence halls by a local firm.

Rentals in the permanent residence halls range from \$75.00 to \$160.00 per student per semester; marginal accommodations are available at \$50.00 per semester.

Information regarding all residence halls can be obtained from the Director of Residence Halls.

FRATERNITIES

Approximately one-third of the student body lives in fraternity houses. Such accommodations, of course, are available only to sophomores and upperclassmen who receive invitations to join the group.

APARTMENTS

To the extent of its ability, the University assists married students in obtaining furnished or unfurnished apartments. Married students are referred to the Bureau of Housing Information for such assistance as this agency can render. A personal visit to the Bureau, well in advance of the date on which the student expects to enroll at the University, is highly advisable.

DINING SERVICE

The University operates a cafeteria in Lamberton Hall for the accommodation of the student body. Eating at the cafeteria is on a voluntary basis. Board is *not* furnished on a weekly, monthly or semester basis. Regular meals are served daily from Monday through Saturday noon while the University is in session.

Use of Motor Vehicles at Lehigh University

Permission for students in Lehigh University to have and drive motor vehicles while in residence is granted so long as there is no evidence that having a motor vehicle at college interferes with academic progress and the demands of good citizenship, *EXCEPT THAT:*

1. A freshman in Lehigh University is not permitted to have or operate a motor vehicle at college before the mid-term marking period of the first semester, and only then under the following conditions:

- a. He received no failing grades at mid-term.
- b. He has been the subject of no disciplinary action of any kind.
- c. His parent specifically requests that he may be permitted to bring a motor vehicle to college.
- d. The student and the car are adequately covered by liability insurance.
- e. Official permission has been received by the student from the Dean of Students.

2. If at any time a student classified as an academic freshman shall be placed on scholastic or valentine probation, or is the subject of disciplinary action, all motor vehicle privileges shall be withdrawn until he is again in good standing and has *reapplied* for motor vehicle privileges:

3. Exceptions to the above regulations may be made by the Dean of Students for commuting freshmen, freshmen living at home, or for other exceptional reasons, upon petition from the student.

The College of
Arts and Science

The College of Arts and Science

Administrative Officers

Martin Dewey Whitaker, *President*

Earl Kenneth Smiley, *Vice-President*

Robert Pattison More, *Dean of the College of Arts
and Science*

Wray Hollowell Congdon, *Dean of Students*

Charles Augustus Seidle, *Director of Admissions*

James Harold Wagner, *Registrar*

The College of Arts and Science of Lehigh University comprises the departments of biology, classical languages, education, English, fine arts, geology, German, history and government, international relations, mathematics and astronomy, music, philosophy, psychology, religion, and romance languages. Courses in economics, sociology, accounting, and finance are provided by the College of Business Administration; physics and chemistry are supplied by the College of Engineering.

The degree of Bachelor of Arts is conferred upon graduates of the College.

PURPOSES

Under the name "School of General Literature," The College of Arts and Science was a part of the original plan of the University, and its aims have remained constant although the means employed have been adapted to the changing times.

The purpose of the College is to prepare a man for the exercise of his individual responsibility in the affairs of mature life. This purpose recognizes three distinguishing characteristics of an educated man: the ability to think in a disciplined manner, the ability and willingness to make discriminating judgments, and the capacity to apply his creative imagination.

In order to achieve this purpose the faculty shares with the student the range of human knowledge: the world of fact, and its counterpart, the world of ideas. The fundamentals of this experience remain what they have been for generations: a comprehensive study of all the broad areas of knowledge—the Humanities,

the Natural and Physical Sciences and the Social Sciences — and a rigorous training in one of them.

REQUIREMENTS FOR GRADUATION

1. The completion of one hundred twenty credit hours of collegiate work, apportioned so as to cover the distribution and concentration requirements, in addition to basic military or air science and tactics, and physical education, required of all students.
2. The passing of a comprehensive examination in the major field.

THE COURSE OF STUDY

Each student in the College of Arts and Science is considered from the beginning of his course as an individual. The College expects every student to have a well-defined purpose at entrance, but recognizes the student's right to change his objective, and for that reason gives him two years in which to find himself and establish the direction of his future career. To help the student in his decision, the College provides an advisory staff consisting of the dean of the College, who is adviser of freshmen, and the heads of departments in which major sequences are given. The individual program for each student is outlined tentatively in an interview with the dean of the College during freshman week. This preliminary program is determined by the nature and quality of the student's preparation and by the student's personal interests. The final program, which is made out in detail at the end of the sophomore year, takes into account, in addition, demonstrated aptitudes and pre-professional or vocational needs.

These individual programs admit of considerable elective choice. The number of elective courses depends upon the demands of the distribution and concentration requirements, which occupy from sixty to eighty per cent of the student's time. The number of purely elective hours ranges from twenty-one to forty-five out of the hundred and twenty required for graduation. In general the student in the College of Arts and Science may elect any undergraduate course given at the University for which he has the prerequisites. This privilege, combined with the wide choice offered by the major sequences, *i. e.*, the concentration requirements, enables the College to provide specialization in a large number of fields and preparation for individual careers.

PREPARATION FOR PROFESSIONAL SCHOOLS AND THE PROFESSIONS

The College of Arts and Science provides the preliminary training necessary for admission to the various graduate schools and, in some cases, prepares directly for a profession. Since a large proportion of the graduates of the College of Arts and Science of Lehigh University continue their work in graduate schools, the College offers a number of course combinations designed to give preliminary training for the various fields of medicine, dentistry, public service, public health, law, theology, engineering, business administration, etc. Students who are looking forward toward any one of the graduate schools should consult the dean of the College, who will assist them in planning their courses.

THE FIVE-YEAR COMBINED COURSE IN ARTS AND ENGINEERING

In the five-year combined course in Arts and Engineering, the opportunity exists for the student to provide himself with an unusually broad educational background for his career. Recognition that the demands of our society increasingly call for knowledge of and appreciation for the arts as well as the highest of technical skills suggests the consideration of this course whenever circumstances permit. At Lehigh, the entire program can be undertaken without transfer to another institution. Students will meet all the distribution requirements of the College of Arts and Science. Those who are preparing for civil, electrical, industrial, mechanical, metallurgical, or mining engineering will take as a major sequence all of the work in science, mathematics, and engineering prescribed for the first three years of the engineering curriculum of their choice. Their senior comprehensive examination will normally be the Graduate Record Examination in engineering. Students who plan to combine the curriculum in Arts and Science with either the curriculum leading to the B.S. in Chemistry or Chemical Engineering, or that leading to the B.S. in Engineering Physics, will take as their major sequence the regular major in chemistry or in physics, as the case may be.

At the end of four years of successful study, the B.A. degree is conferred. For the fifth year, the student transfers to the College of Engineering and completes the requirements for the engineering degree in one more year. In some instances it may be advisable to take the two degrees at the end of the fifth year.

THE CURRICULUM

The curriculum is based upon the principles of distribution and concentration. The object of the distribution requirements is to give the student an elementary knowledge of the fields of contemporary thought and to orient him in the world of man and nature.

Distribution Requirements

The distribution requirements are administered by the dean of the College of Arts and Science in accord with the group regulations given below. The subjects required of the individual student depend in part upon the field in which he expects to major, in part upon his personal preference, and in part upon the subjects he has taken in secondary school.

GROUP I

ENGLISH. The normal requirement in English is Engl. 1 and 2, Composition and Literature, six semester hours, in the freshman year, and six semester hours of English or American literature in the sophomore year, a total of twelve hours. Students who demonstrate satisfactory ability in written composition in the freshman placement tests will meet the distribution requirement by passing Engl. 11 and 12, Types of World Literature, six semester hours. Three extra hours of composition, carrying no credit toward graduation, must be taken and passed by those whose preparation, as evidenced by the placement tests, has been poor.

FOREIGN LANGUAGES: Students in the College of Arts and Science normally are required to complete successfully the equivalent of two years of college work in one foreign language beyond the elementary level, the latter term being understood to mean two years in secondary school or one year in college. The requirement may be met either by passing an examination or by pursuing in course the language to be used in satisfaction of the requirement. Students who present at entrance three or four years of a foreign language may meet this requirement with one year of advanced college work.

An option is offered those who find it necessary or, as part of their preparation for chosen fields of endeavor, desirable to pursue in college the study of foreign languages other than the language or languages studied in secondary school. Such students may offer

in satisfaction of the language requirement two years of one foreign language and one year of another.

FINE ARTS OR MUSIC. Three semester hours.

PHILOSOPHY OR RELIGION. Three semester hours.

GROUP II

SCIENCE. Twelve semester hours, chosen from at least three of the following fields: astronomy, biology, chemistry, geology, mathematics, physics, psychology.

Normally, a student will take work in fields not represented among those studied in secondary school. However, if work taken in secondary school is not regarded as being the equivalent of prerequisites of courses which the student expects to take later, he will take the Lehigh courses specified as prerequisites, and full credit for the latter will be given toward the satisfaction of the distribution requirement.

GROUP III

SOCIAL SCIENCE. Twelve semester hours, chosen from at least three of the following fields: ancient civilization, economics, education, government, history, international relations, sociology.

Concentration Requirements

During the second semester of the freshman year each student must select some sequence of studies as his major field. A major consists of at least twelve semester hours of advanced work in the field chosen. Including preliminary college work, the minimum number of hours constituting a major is twenty-four. Change of major is permitted up to the end of the sophomore year. Majors must be approved by the professors and the dean of the College.

The major work is designed to enable a student to master his chosen field so far as that is possible in the two years devoted to the subject. In all fields certain courses are prescribed, but the mere passing of courses will not satisfy the major requirements. It is expected that the student will read widely in his subject and prepare himself largely through his own reading and his own independent work for his final comprehensive examination. After a student has selected a major subject, the head of the department in which the major is selected becomes the official adviser of the student and guides him in his choice of courses.

Comprehensive Examination

A comprehensive examination in the major subject is required of all students. This examination is given at the end of the senior year and may be oral or written or both. The comprehensive examination is given under the direction of the head of the major department. At least two university teachers and, whenever possible, representatives of at least two departments take part in the examination.

No student is allowed to take the senior comprehensive examination more than twice in any one field. In case of failure on the first attempt, a second trial is not permitted until a period of three months has passed.

UNSCHEDULED WORK

On the advice of the head of the department in which the major work is being done and with the consent of the dean of the College, a senior of unusual merit who wishes to concentrate in his chosen field may be allowed to substitute not more than six hours of unscheduled work per semester for six hours of elective work otherwise required for graduation.

SPECIAL HONORS

Special honors are awarded at the end of the senior year, on recommendation of the head of the department concerned and by vote of the faculty, to students who have done advanced work of unusual merit in some chosen field. Candidates for special honors must indicate during their junior year their intention to work for such honors. Awards are based on grades obtained in the subject chosen, the results in extra work assigned, and the general proficiency of the candidate as evidenced by either a final examination or a thesis, as the head of the department involved may direct. No student who fails to pass his comprehensive examination with distinction is graduated with special honors.

SPECIAL REGULATIONS FOR ENGLISH

Students in the College of Arts and Science who persistently use poor English may be reported at any time to the dean of the College. He may require that they take additional English without credit toward graduation.

Toward the end of the junior year each junior in the College of Arts and Science must report to the department of English for an exercise in impromptu writing. Students found seriously deficient in this test are reported to the dean of the College, who may require that they take additional English without credit toward graduation.

DETAILS OF CONCENTRATION REQUIREMENTS

Major Sequences

BIOLOGY. Two majors are offered by the department of biology: zoology and bacteriology.

Zoology. This major is designed for men who intend to enter medical school or to continue advanced instruction in a graduate school.

<i>Required Courses: Elementary</i>		
Biol.	31, 32.	Zoology(6)
<i>Required Courses: Advanced</i>		
Biol.	3.	Comparative Anatomy(3)
Biol.	4.	Embryology(3)
Biol.	6.	Botany(3)
Biol.	18.	Genetics(2)
Biol.	61, 62.	Bacteriology(6)
Biol.	120.	Physiology(3)
Biol.	313.	Histology(3)
Biol.	358.	Immunology(3)

Bacteriology. This major is for men who intend to go into public health work or bacteriology either upon graduation or following graduate study.

<i>Required Courses: Elementary</i>		
Biol.	31, 32.	Zoology(6)
<i>Required Courses: Advanced</i>		
Biol.	6.	Botany(3)
Biol.	18.	Genetics(2)
Biol.	61, 62.	Bacteriology(6)
Biol.	313.	Histology(3)
Biol.	353.	Advanced Bacteriology(3)
Biol.	358.	Immunology(3)

<i>Suggested Electives</i>		
Biol.	3.	Comparative Anatomy(3)
Biol.	355.	Industrial Bacteriology(3)
Biol.	361.	Public Sanitation(3)

Students taking their major work in zoology or bacteriology are required to take the following collateral courses.

Chem.	4, 5.	General Chemistry.....(8)
Chem.	35.	Analytical Chemistry.....(4)
Chem.	93.	Elements of Physical Chemistry.....(3)
Chem.	150, 151.	Organic Chemistry.....(6)
Chem.	165.	Organic Chemistry Laboratory.....(2)

LEHIGH UNIVERSITY

Phys.	12.	Introduction to Physics.....	(3)
Phys.	16.	General Physics	(3)
Phys.	17.	General Physics Laboratory.....	(2)
and two of the following courses:			
Math.	1.	Trigonometry	(3)
Math.	11.	Analytic Geometry	(3)
Math.	12.	Calculus I	(3)

Biology: Natural Resources Option. Students interested in natural resources and their conservation may take the major in zoology, slightly modified to permit taking collateral courses in geology and other pertinent fields.

CHEMISTRY.

<i>Required Courses: Elementary</i>			
Chem.	4, 5.	General Chemistry.....	(8)
<i>Required Courses: Advanced</i>			
Chem.	35, 36.	Analytical Chemistry	(8)
Chem.	91.	Physical Chemistry.....	(3)
Chem.	92.	Physical Chemistry Laboratory.....	(1)
Chem.	150, 151.	Organic Chemistry.....	(6)
Chem.	165, 167.	Organic Chemistry Laboratory.....	(4)
Chem.	190.	Physical Chemistry.....	(3)
Chem.	192.	Physical Chemistry Laboratory.....	(1)
Chem.	194.	Physical Chemistry and Electrochemistry.....	(3)
Chem.	197.	Electrochemistry Laboratory.....	(1)
Chem.	302.	Inorganic Chemistry.....	(3)
and at least one of the following:			
Chem.	337.	Advanced Analytical Chemistry.....	(3)
Chem.	357.	Qualitative Organic Chemistry	(3)
Chem.	358.	Advanced Organic Chemistry.....	(3)
Chem.	371.	Biochemistry	(3)
<i>Required Collateral Courses</i>			
Math.	11.	Analytic Geometry	(3)
Math.	12.	Calculus I	(3)
Math.	13.	Calculus II	(3)
and either			
Phys.	12.	Introduction to Physics.....	(3)
Phys.	16.	General Physics	(3)
Phys.	17.	General Physics Laboratory.....	(2)
or			
Phys.	22.	Mechanics and Properties of Matter.....	(4)
Phys.	23.	Heat, Sound and Light.....	(4)
Phys.	24.	Electricity and Magnetism.....	(4)

CLASSICAL LANGUAGES. Students who elect Greek and Latin as a major will choose one of two groups of courses:

Group 1 (Emphasis upon Greek).

<i>Required Courses: Elementary</i>			
Gk.	1, 2.	Elementary Greek.....	(6)
Gk.	3, 4.	Second-Year Greek	(6)
<i>Required Courses: Advanced</i>			
Gk.	7.	Thucydides	(3)
Gk.	8.	Tragedy	(3)
Gk.	9.	Dramatic Poetry	(3)
Gk.	10.	Greek Oratory	(3)
Gk.	116.	Plato	(3)
Gk.	21.	Ancient History	(3)
Lat.	22.	Ancient History	(3)
Gk.	200.	Greek Literature in English Translation.....	(3)
Lat.	201.	Latin Literature in English Translation.....	(3)

Six hours of Latin language, specific courses depending on the student's preparation.

Group 2 (Emphasis upon Latin).

Required Courses: Elementary

Lat.	61.	Beginning Latin	(3)
Lat.	62, 63.	Caesar	(6)
Lat.	64.	Cicero	(3)

Required Courses: Advanced

Lat.	65.	Vergil	(3)
Lat.	66.	Horace	(3)
Lat.	67.	Livy	(3)
Lat.	68.	Latin Drama.....	(3)
Lat.	169.	Satire	(3)
Gk.	21.	Ancient History	(3)
Lat.	22.	Ancient History	(3)
Lat.	201.	Latin Literature in English Translation.....	(3)
Gk.	200.	Greek Literature in English Translation.....	(3)

Six hours of Greek language, specific courses depending upon the student's preparation.

Suggested Electives

Phil.	14.	Logic and Scientific Method.....	(3)
Phil.	231.	Ancient and Medieval Philosophy.....	(3)
Govt.	1.	The Foundations of Government.....	(3)
Hist.	25.	European History.....	(3)
Astr.	1.	Descriptive Astronomy	(3)
Astr.	2.	General Astronomy	(3)
Educ.	330.	History of Education in Europe	(3)

CONSERVATION. See Natural Resources, page (76)

ECONOMICS AND BUSINESS ADMINISTRATION. Three majors are offered in the field of economics and business administration: economics, finance, and accounting.

ECONOMICS.

Required Courses: Elementary

SOPHOMORE YEAR

Eco.	3, 4.	Economics	(6)
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Required Courses: Advanced

JUNIOR YEAR

Eco.	306.	Intermediate Economic Theory	(3)
Eco.	307, 308.	Advanced Economics	(6)
E.S.	145.	Statistical Method	(3)
E.S.	346.	Business Cycles and Forecasting.....	(3)
Fin.	129, 130.	Money and Banking.....	(6)

SENIOR YEAR

Eco.	333.	Labor Problems	(3)
Eco.	236.	Public Utilities.....	(3)
Fin.	241.	International Trade and Finance.....	(3)
Fin.	351.	Public Finance: Federal.....	(3)
Soc.	262.	Social Problems	(3)

Suggested Electives

Acctg.	104.	Accounting for Engineers.....	(3)
Eco.	111.	Marketing	(3)
Eco.	235.	Transportation	(3)
E.S.	347.	National Income Analysis.....	(3)
Hist.	327, 328.	Development of American Institutions.....	(6)
Govt.	357.	City Government.....	(3)
Govt.	360.	Public Administration.....	(3)
I.E.	162, 163.	Industrial Management.....	(6)
Soc.	42.	Principles of Sociology	(3)

Finance.

Required Courses: Elementary

SOPHOMORE YEAR

Eco.	3, 4.	Economics	(6)
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Required Courses: Advanced

JUNIOR YEAR

Fin.	125, 126.	Corporation Finance	(6)
Fin.	129, 130.	Money and Banking.....	(6)
E.S.	145.	Statistical Method.....	(3)
Acctg.	104.	Accounting for Engineers.....	(3)

SENIOR YEAR

Fin.	323.	Investments	(3)
Fin.	351.	Public Finance	(3)
plus 12 hours selected from the following:			
Eco.	160.	Insurance	(3)
Eco.	333.	Labor Problems	(3)
Fin.	153.	Credits and Collections.....	(3)
Fin.	232.	Monetary-Fiscal Policy.....	(3)
Fin.	324.	Investments	(3)
Fin.	331.	Bank Credit Problems.....	(3)
Fin.	241, 342.	International Trade and Finance.....	(6)

Suggested Electives

Acctg.	1, 2.	Accounting	(6)
Acctg.	313, 314.	Intermediate Accounting.....	(6)
Eco.	306.	Intermediate Economic Theory.....	(3)
E.S.	346.	Business Cycles and Forecasting.....	(3)

Accounting.

Required Courses: Elementary

Acctg.	1, 2.	Accounting	(6)
Eco.	3, 4.	Economics	(6)

Required Courses: Advanced

Acctg.	13, 14.	Intermediate Accounting.....	(3)
Acctg.	115.	Cost Accounting.....	(3)
Fin.	125, 126.	Corporation Finance	(6)
Law	101, 102.	Business Law	(6)
Law	204.	Wills, Estates, and Trusts	(3)
plus nine semester hours to be selected from the following:			
Acctg.	203.	Federal Tax Accounting.....	(3)
Acctg.	218.	Advanced Cost Accounting	(3)
Acctg.	219.	Specialized Accounting Systems	(3)
Acctg.	315.	Advanced Accounting.....	(3)
Acctg.	320.	Auditing	(3)

*Suggested Electives**

Eco.	306.	Intermediate Economic Theory.....	(3)
E.S.	145.	Statistical Method.....	(3)
E.S.	346.	Business Cycles and Forecasting.....	(3)
Fin.	323.	Investments	(3)

*The New York State Board of Certified Public Accountant Examiners and the New Jersey State Board of Accountants require 8 credit hours in finance of candidates for the C.P.A. examinations in their states. Also, the New Jersey Board demands 30 credit hours of accounting. Therefore it is recommended that students who anticipate becoming candidates in either state take 3 additional credit hours of finance, and that prospective New Jersey candidates also take 6 additional credit hours in accounting, as part of their elective programs.

Education.

<i>Required Courses: Elementary</i>		
Educ.	1.	Introduction to Education.....(3)
Psych.	1.	Elementary Psychology.....(3)
Educ.	20.	Educational Psychology.....(3)
<i>Required Courses: Advanced</i>		
Educ.	152.	Principles of High School Teaching.....(3)
Educ.	153.	Observation of Secondary School Teaching.....(3)
Educ.	154.	Practice Teaching of Secondary School Subjects.....(3)
Educ.	331.	History of Education in the United States.....(3)
Educ.	350.	Principles of Secondary Education.....(3)
		Electives.....(3)
<i>Required Courses: Collateral</i>		
Speech	30.	Fundamentals of Speech.....(3)
Biol.	13.	Human Biology.....(3)

ENGLISH. Two majors are offered by the department of English: English literature, and journalism.

ENGLISH LITERATURE. Students looking forward to teaching English or taking graduate courses for advanced degrees should elect this major.

<i>Required Courses: Elementary</i>		
Engl.	1, 2.	Composition and Literature.....(6)
or		
Engl.	11, 12.	Types of World Literature.....(6)
and six semester hours from the following courses:		
Engl.	4, 5.	A Study of the Drama.....(6)
Engl.	7.	The Short Story.....(3)
Engl.	8, 9.	English Literature.....(6)
Engl.	11, 12.	Types of World Literature.....(6)
Engl.	20, 21.	American Literature.....(6)
Engl.	35.	Poetry.....(3)
<i>Required Courses: Advanced</i>		
Engl.	323, 324.	Shakespeare and the Elizabethan Drama.....(6)
and eighteen semester hours from the following courses:		
Engl.	183, 184.	Readings in English Literature.....(6)
Engl.	321.	Contemporary American Literature.....(3)
Engl.	322.	Contemporary English Literature.....(3)
Engl.	325.	English Literature of the Romantic Era.....(3)
Engl.	326.	English Literature of the Victorian Era.....(3)
Engl.	331.	Milton.....(3)
Engl.	333.	Restoration and Augustan Literature.....(3)
Engl.	334.	The Age of Johnson.....(3)
Engl.	335.	History of the English Language.....(3)
Engl.	336.	Writing for Publication.....(3)
Engl.	337.	The Renaissance.....(3)
Engl.	338.	The Seventeenth Century.....(3)

Students planning to pursue graduate studies should have a reading knowledge of German, French, and Latin.

Journalism.

The division of journalism offers five programs of study leading toward specialization in the following areas of communications: (1) newspaper practice; (2) government information;

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(3) communications in industry; (4) management of natural resources; (5) business and technical publications. Journalism majors are advised to declare enrollment in one of these programs at the beginning of their sophomore year in order to obtain an early start in the differentiating collateral courses.

<i>Required Courses: Elementary</i>		
Journ.	1-4.	Brown and White, four semesters.....(4)
<i>Required Courses: Advanced</i>		
Journ.	11.	Newspaper Reporting and Writing(3)
Journ.	12.	Advanced Newspaper Reporting and Writing.....(3)
Journ.	13.	Newspaper Editing and Copyreading.....(3)
Journ.	15.	Editorial Writing(3)
Journ.	16.	Law of the Press.....(3)
Journ.	17.	Magazine Article Writing.....(3)
Journ.	118.	History of American Journalism.....(3)
Journ.	120.	Journalism Proseminar.....(3)
<i>Suggested Electives</i>		
Journ.	5-8.	Brown and White.....(4)
Journ.	14.	Press Photography(3)
Journ.	21.	Creative Writing(6)
Journ.	31, 32.	Community Journalism.....(6)
Journ.	43.	Communications in Industry.....(3)
Journ.	123.	Editing the House Organ and Trade Publication.....(1)

FINE ARTS.

<i>Required Courses: Elementary</i>		
F.A.	11.	Ancient and Medieval Art.....(3)
F.A.	12.	The Art of the Italian Renaissance.....(3)
and six semester hours from the following:		
F.A.	5, 6.	Freehand Drawing.....(3)
F.A.	7, 8.	Advanced Drawing and Painting.....(3)
<i>Required Courses: Advanced</i>		
F.A.	3, 4.	History of Architecture.....(6)
F.A.	13.	The Art of the Northern Renaissance.....(3)
F.A.	14.	Modern Art.....(3)
F.A.	17, 18.	Criticism and Analysis of Art.....(6)
<i>Required Collateral Courses</i>		
Mus.	13, 14.	Introduction to Music Literature.....(6)
Phil.	151.	The Philosophy of Art.....(3)
Courses in history and foreign language.		

GEOLOGY.

<i>Required Courses: Elementary</i>		
Geol.	1.	Principles of Geology.....(3)
or		
Geol.	4.	Engineering Geology.....(4)
Geol.	12.	Historical Geology.....(3)
Geol.	31.	Mineralogy(3)
Geol.	32.	Petrology(3)
<i>Required Courses: Advanced</i>		
Geol.	42.	Geologic Surveying(1)
Geol.	43.	Cartography(1)
Geol.	141.	Field Geology.....(3)
or		
Geol.	146.	Field Problems(3)
Geol.	223.	Structural Geology.....(3)

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Geol.	311.	Paleontology	(3)
Geol.	312.	Stratigraphy	(3)
Geol.	342.	Field Trip	(1)
Geol.	344.	Field Trip	(1)
and at least six semester hours from the following:			
Geol.	146.	Field Problems.....	(3)
Geol.	255, 256.	Mineral Resources.....	(6)
Geol.	331.	Optical Crystallography	(3)
Geol.	332.	Petrography	(3)
Geol.	361.	Water Resources.....	(3)
Geol.	362.	Soil Resources.....	(3)
<i>Required Collateral Courses</i>			
Math.	1.	Trigonometry	(3)
C.E.	61.	Engineering Drawing and Descriptive Geometry.....	(3)
C.E.	40.	Land and Topographic Surveying.....	(3)
Chem.	4, 5.	General Chemistry.....	(8)
Phys.	12.	Introduction to Physics.....	(3)
Phys.	16.	General Physics	(3)
Min.	161.	Mining Engineering.....	(3)

Certain variations in the major courses and the suggested electives may be made, depending upon the branch of geology in which the student is interested. For example, six hours of biology are recommended for men interested in paleontology. Additional courses in mathematics are recommended for those interested in certain other branches, such as geochemistry or geophysics. Summer employment in surveying may, with the approval of the department head, be substituted for C.E. 40. A reading knowledge of French and German is recommended.

GEOLOGY: Natural Resources Option: Students interested in natural resources and their conservation may take a major in geology, slightly modified to permit taking collateral courses in biology and other pertinent fields.

GERMAN.

Required Courses: Elementary

Ger.	1, 2.	Elementary German	(6)
Ger.	3, 4.	Intermediate German.....	(6)

Required Courses: Advanced

Ger.	9.	Advanced German	(3)
Ger.	10.	Goethe's Faust	(3)
Ger.	13, 14.	Lessing, Goethe, and Schiller.....	(6)
Ger.	22.	Conversation and Composition	(3)
Ger.	211, 212.	Nineteenth Century German Drama.....	(6)
Ger.	215, 216.	The German Short Story.....	(6)

Suggested Electives

Hist.	25, 26.	European History.....	(6)
Hist.	331, 332.	Intellectual Expansion of Modern Europe.....	(6)
Phil.	232.	Modern Philosophy	(3)
Phil.	237.	Nineteenth Century Philosophy.....	(3)

In addition, the student will be expected to have a knowledge of the history of German literature. A list of readings in English

and German is furnished the student at the beginning of his major work.

HISTORY AND GOVERNMENT. The department of history and government offers to undergraduates courses which provide a basis for law school, government service, journalism, teaching or graduate work in the fields of history and government. It aims at developing an understanding of the historical evolution of the world in which we live. Its courses emphasize developing habits or critical analysis which aid the student in an objective understanding of the larger human and political questions of today.

Four majors are offered by the department of history and government: American history, European history, government and a general major.

American History.

Required Courses: Elementary

Hist.	13,	14.	United States History.....	(6)
Hist.	25,	26.	European History.....	(6)
Govt.	51.		American National Government.....	(3)

Required Courses: Advanced

Twelve hours from the following:

Hist.	320.		Eighteenth Century European Imperialism.....	(3)
Hist.	327,	328.	Development of American Institutions.....	(6)
Hist.	329,	330.	American Foreign Policy	(6)
Hist.	251.		United States and Pennsylvania History.....	(3)

Six hours from the following:

Hist.	27,	28.	European Expansion and Empire Building.....	(6)
Hist.	29,	30.	Modern Europe.....	(6)
Hist.	315,	316.	Political and Social History of England.....	(6)
Hist.	317,	318.	The Middle East in World History.....	(6)
Hist.	319.		Eighteenth Century European Civilization.....	(3)
Hist.	331,	332.	Intellectual Expansion of Modern Europe.....	(6)
Hist.	341,	342.	Expansion of the English-speaking Peoples.....	(6)
Hist.	349,	350.	Hispanic America.....	(6)
Govt.	1.		Foundations of Government.....	(3)
Govt.	2.		American Political Ideas.....	(3)

Six hours from the following:

Govt.	1.		Foundations of Government.....	(3)
Govt.	2.		American Political Ideas.....	(3)
Govt.	52.		American State and Local Government.....	(3)
Govt.	351.		Constitutional Law	(3)
Govt.	352.		Civil Rights.....	(3)
Govt.	357.		City Government	(3)
Int. Rel.	341,	342.	International Relations	(6)
Int. Rel.	351,	352.	International Organization.....	(6)
Int. Rel.	361,	362.	International Law.....	(6)

Suggested Electives

Eco.	3,	4.	Economics	(6)
Engl.	20,	21.	American Literature.....	(6)
Soc.	41.		Cultural Anthropology	(3)
Soc.	42.		Principles of Sociology.....	(3)

European History.

Required Courses: Elementary

Hist.	13, 14.	United States History.....	(6)
Hist.	25, 26.	European History.....	(6)

Required Courses: Advanced

Hist.	319.	Eighteenth Century European Civilization.....	(3)
Hist.	331, 332.	Intellectual Expansion of Modern Europe.....	(6)

Twelve hours from the following:

Hist.	27, 28.	European Expansion and Empire Building.....	(6)
Hist.	29, 30.	Modern Europe.....	(6)
Hist.	315, 316.	Political and Social History of England.....	(6)
Hist.	317, 318.	The Middle East in World History.....	(6)
Hist.	341, 342.	Expansion of the English-speaking Peoples.....	(6)

Six hours from the following:

Hist.	320.	Eighteenth Century European Imperialism.....	(3)
Hist.	327, 328.	Development of American Institutions.....	(6)
Hist.	329, 330.	American Foreign Policy	(6)
Hist.	349, 350.	Hispanic America.....	(6)
Govt.	3.	Foreign Governments	(3)
Govt.	6.	Democracy	(3)
Govt.	101.	History of Political Thought.....	(3)
Govt.	363, 364.	Contemporary Political Thought.....	(6)

Suggested Electives

Eco.	3, 4.	Economics	(6)
Engl.	8, 9.	English Literature	(6)
Int. Rel.	11, 12.	Diplomacy of Europe.....	(6)
Int. Rel.	361, 362.	International Law	(6)
Gk.	21.	Ancient History	(3)
Lat.	22.	Ancient History	(3)
Rel.	8.	History of Christianity in Europe and America.....	(3)

Government.

Required Courses: Elementary

Govt.	1.	Foundations of Government.....	(3)
Govt.	2.	American Political Ideas.....	(3)
Govt.	6.	Democracy	(3)
Govt.	3.	Foreign Governments	(3)

Required Courses: Advanced

Govt.	51, 52.	American Government	(6)
Govt.	359, 360.	Law Making and Public Administration.....	(6)
Govt.	357.	City Government	(3)
Govt.	363, 364.	Contemporary Political Thought.....	(6)

plus nine hours selected from the following:

Govt.	4.	Political Parties and Electoral Problems.....	(3)
Govt.	101.	History of Political Thought.....	(3)
Govt.	351.	Constitutional Law	(3)
Govt.	352.	Civil Rights.....	(3)
Govt.	354.	Administrative Law.....	(3)

plus six hours to be selected, with the approval of the political science staff, from the fields of ancient, medieval, or modern history or international relations.

Suggested Electives

Majors in government will find it advantageous to enroll for certain courses in the fields of public finance, economics, sociology, philosophy, psychology and journalism. The particular course selections should be made in consultation with the political science staff.

General Major. Students looking forward to teaching the social sciences in the public schools should take this major.

Required Courses: Elementary

Hist.	13.	14.	United States History.....	(6)
Hist.	25.	26.	European History.....	(6)
Govt.	1.		Foundations of Government.....	(3)

Required Courses: Advanced

Hist.	315.	316.	Political and Social History of England.....	(6)
Govt.	51.		American National Government.....	(3)
plus twelve semester hours to be selected from the following:				
Hist.	317.	318.	The Middle East in World History.....	(6)
Hist.	319.	320.	Eighteenth Century European Civilization and Imperialism.....	(6)
Hist.	329.	330.	American Foreign Policy.....	(6)
Hist.	331.	332.	Intellectual Expansion of Modern Europe.....	(6)
Hist.	341.	342.	Expansion of the English-speaking Peoples.....	(6)
Govt.	3.		Foreign Governments.....	(3)
Govt.	363.	364.	Contemporary Political Thought.....	(6)
and three semester hours to be selected from the following:				
Hist.	29.	30.	Modern Europe.....	(6)
Int. Rel.	11.	12.	Diplomacy of Europe.....	(6)
Int. Rel.	21.	22.	Diplomacy of the Far East.....	(6)
Int. Rel.	133.	134.	Diplomacy of Russia and the Middle East.....	(6)
Int. Rel.	351.	352.	International Organization.....	(6)
Int. Rel.	361.	362.	International Law.....	(6)

Suggested Electives

Eco.	3.	4.	Economics.....	(6)
Engl.	20.	21.	American Literature.....	(6)
Eco.	50.		Economic Geography.....	(3)
Int. Rel.	312.		World Affairs since 1919.....	(3)
Int. Rel.	341.	342.	International Relations.....	(6)
Soc.	42.		Principles of Sociology.....	(3)

INTERNATIONAL RELATIONS. This major is designed for men aspiring to the United States Foreign Service, to journalism on the international plane, to commercial employment abroad, or to advanced study in the field, and for those whose intellectual interests lie across national frontiers. Students contemplating a career in the United States Foreign Service are advised to continue language study throughout their course.

Required Courses: Elementary

Int. Rel.	1.	2.	Diplomacy.....	(6)
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Required Courses: Advanced

Int. Rel.	341.	342.	International Relations.....	(6)
Int. Rel.	351.	352.	International Organization.....	(6)
Int. Rel.	361.	362.	International Law.....	(6)
and twelve semester hours to be selected from the following:				
Int. Rel.	11.	12.	Diplomacy of Europe.....	(6)
Int. Rel.	21.	22.	Diplomacy of the Far East.....	(6)
Int. Rel.	133.	134.	Diplomacy of Russia and the Middle East.....	(6)
Int. Rel.	312.		World Affairs since 1919.....	(3)
Int. Rel.	322.		The Far East in World Affairs.....	(3)
Int. Rel.	332.		The Soviet Union in World Affairs.....	(3)
Int. Rel.	371.	372.	Readings in International Relations.....	(3)
Hist.	317.	318.	The Middle East in World History.....	(6)
Hist.	329.	330.	American Foreign Policy.....	(6)
Hist.	349.	350.	Hispanic America in the Nineteenth and Twentieth Centuries.....	(6)
Govt.	3.		Foreign Governments.....	(3)
Govt.	6.		Democracy.....	(3)

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Govt.	51.	American National Government.....	(3)
Govt.	352.	Civil Rights.....	(3)
Govt.	363, 364.	Contemporary Political Thought.....	(6)

Suggested Electives

Acctg.	104.	Accounting for Engineers.....	(3)
E.S.	145.	Statistical Method	(3)
Eco.	3, 4.	Economics	(6)
Eco.	50.	Economic Geography.....	(3)
Eco.	236.	Public Utilities.....	(3)
Eco.	306.	Intermediate Economic Theory.....	(3)
Fin.	125.	Corporation Finance.....	(3)
Fin.	133.	Money and Banking.....	(3)
Fin.	241, 242.	International Trade and Finance.....	(6)
Govt.	1.	Foundations of Government.....	(3)
Govt.	52.	American State and Local Government.....	(3)
Hist.	13, 14.	United States History.....	(6)
Hist.	25, 26.	European History.....	(6)
Hist.	28.	European Expansion and Empire Building.....	(3)
Hist.	29, 30.	Modern Europe.....	(6)
Hist.	327, 328.	Development of American Institutions.....	(6)
Hist.	332.	Intellectual Expansion of Modern Europe.....	(3)
Hist.	342.	Expansion of the English-speaking Peoples.....	(3)
Phil.	281.	Philosophy of the Social Sciences.....	(3)
Psych.	304.	Elementary Social Psychology	(3)
Soc.	42.	Principles of Sociology.....	(3)

MATHEMATICS AND ASTRONOMY. Three majors are offered by the department of mathematics and astronomy: mathematics, mathematics and astronomy, and actuarial science.

Mathematics.

Required Courses: Elementary

Math.	11.	Analytic Geometry.....	(3)
Math.	12.	Calculus I.....	(3)
Math.	13.	Calculus II.....	(3)
Math.	14.	Calculus III.....	(3)

Required Courses: Advanced

Math.	51.	Advanced Algebra.....	(3)
Math.	54.	Higher Geometry.....	(3)
Math.	219, 220.	Principles of Analysis.....	(6)
Math.	221.	Differential Equations.....	(3)
Math.	315.	Theory of Functions of a Complex Variable.....	(3)

Three additional hours from the courses in mathematics numbered from 100 to 399.

Mathematics and Astronomy.

Required Courses: Elementary

Astr.	1.	Descriptive Astronomy	(3)
Math.	11.	Analytic Geometry.....	(3)
Math.	12.	Calculus I.....	(3)
Math.	13.	Calculus II.....	(3)
Math.	14.	Calculus III.....	(3)

Required Courses: Advanced

Astr.	2.	General Astronomy.....	(3)
Astr.	103.	Practical Astronomy.....	(3)
Astr.	104.	Stellar Astronomy and Astrophysics.....	(3)
Math.	219, 220.	Principles of Analysis.....	(6)
Math.	221.	Differential Equations.....	(3)

Actuarial Science.

Required Courses: Elementary

Math.	11.	Analytic Geometry.....	(3)
Math.	12.	Calculus I.....	(3)
Math.	13.	Calculus II.....	(3)
Math.	14.	Calculus III.....	(3)
Math.	40.	Mathematics of Finance.....	(3)

Required Courses: Advanced

Math.	43.	First Course in Mathematics of Life Insurance.....	(3)
Math.	51.	Advanced Algebra.....	(3)
Math.	102.	Finite Differences.....	(3)
Math.	123.	Probability.....	(3)
Math.	219.	Principles of Analysis.....	(3)
Math.	233.	Mathematical Statistics.....	(3)

Suggested Electives

Acctg.	1.	2.	Accounting.....	(6)
Eco.	3.	4.	Economics.....	(6)
Eco.	160.		Insurance.....	(3)
Eco.	306.		Intermediate Economic Theory.....	(3)
Fin.	125.		Corporation Finance.....	(3)
Math.	220.		Principles of Analysis.....	(3)

NATURAL RESOURCES. An interdepartmental major planned to give the student the basic preparation for a career in the management and conservation of our natural resources, or for graduate work leading to such a career. The major is under the direction of Professor Trembley of the Department of Biology.

Required Courses

Biol.	6.	32.	Botany.....	(3)
Biol.	31.		Zoology.....	(6)
Biol.	61.		Bacteriology.....	(3)
Biol.	206.		Natural History and Ecology.....	(3)
Chem.	4.	5.	General Chemistry.....	(8)
Chem.	35.		Analytical Chemistry.....	(4)
Chem.	93.		Physical Chemistry.....	(3)
Geol.	1.		Principles of Geology.....	(3)
Geol.	12.		Historical Geology.....	(3)
Geol.	31.		Mineralogy.....	(3)
Geol.	42.		Geologic Surveying.....	(1)
Geol.	43.		Cartography.....	(1)
Geol.	361.		Water Resources.....	(3)
Geol.	362.		Soil Resources.....	(3)
Geol.	371.		Meteorology.....	(3)
Geol.	372.		Climatology.....	(3)
Math.	1.		Trigonometry.....	(3)
Phys.	12.		Introduction to Physics.....	(3)
Phys.	16.		General Physics.....	(3)
Phys.	17.		General Physics Laboratory.....	(2)

Suggested Electives

Biol.	18.		Genetics.....	(2)
Biol.	36.		Economic Botany.....	(3)
Chem.	150.		Organic Chemistry.....	(3)
Geol.	32.		Petrology.....	(3)
Geol.	181 or 182.		Geological Problems.....	(1-4)
Geol.	225.		Structural Geology.....	(3)
Geol.	312.		Stratigraphy.....	(3)
Geol.	342 or 344.		Field Trip.....	(1)
Math.	42.		Introduction to Mathematics of Statistics.....	(3)

A student who is taking a major in biology, geology, or journalism, and who is interested in natural resources and their conservation, should consult with his major adviser. His program can be so arranged as to provide an adequate major concentration combined with appropriate collateral work so selected as to develop his knowledge of natural resources and the problems of their management.

PHILOSOPHY.

Required Courses: Elementary

Phil.	3.	Introduction to Philosophy	(3)
Phil.	14.	Logic and Scientific Method.....	(3)
Phil.	15.	Ethics: The Theory of Conduct.....	(3)

Required Courses: Advanced

Phil.	231.	Ancient and Medieval Philosophy	(3)
Phil.	232.	Modern Philosophy.....	(3)

and fifteen additional hours, at least nine of which shall be chosen from the courses listed below. The other six may be taken from appropriate advanced courses in other fields as approved by the head of the department of philosophy.

Phil.	151.	Philosophy of Art.....	(3)
Phil.	171, 172.	Readings in Philosophy	(6)
Phil.	237.	Nineteenth Century Philosophy.....	(3)
Phil.	238.	Twentieth Century Philosophy.....	(3)
Phil.	261.	Philosophy of Natural Sciences.....	(3)
Phil.	263.	Special Topics in the Philosophy of Physics and Mathematics.....	(3)
Phil.	281.	Philosophy of the Social Sciences.....	(3)
Math.	303.	Mathematical Logic.....	(3)

PHYSICS.

Required Courses: Elementary

Phys.	12.	Introduction to Physics.....	(3)
Phys.	16.	General Physics	(3)
Phys.	17.	General Physics Laboratory	(2)
or			
Phys.	22.	Mechanics and Properties of Matter.....	(4)
Phys.	23.	Heat, Sound, and Light.....	(4)
Phys.	24.	Electricity and Magnetism.....	(4)

Required Courses: Advanced

Phys.	110, 111.	Electrical Laboratory.....	(2)
Phys.	171.	Proseminar	(1)
Phys.	191.	Laboratory Techniques.....	(1)
Phys.	192, 193.	Advanced Physics Laboratory	(2)
Phys.	212, 213.	Introductory Theory of Electricity and Magnetism.....	(6)
Phys.	252.	Geometrical and Physical Optics.....	(4)
Phys.	268, 269.	Introduction to Modern Physical Theories.....	(6)
Phys.	314.	Physics of Electronics.....	(4)
Phys.	340.	Heat, Thermodynamics, and Pyrometry.....	(4)

Required Courses: Collateral

Math.	11.	Analytic Geometry	(3)
Math.	12.	Calculus I	(3)
Math.	13.	Calculus II	(3)
Math.	14.	Calculus III.....	(3)
Math.	206.	Advanced Calculus	(3)
or			
Math.	219, 220.	Principles of Analysis.....	(6)
Mech.	3.	Statics and Dynamics	(3)

PSYCHOLOGY. Four majors are offered by the department of psychology: general, industrial, preclinical, and premedical.

General Psychology: for majors with an interest in research and teaching and the intention of continuing in graduate work.

Required Courses: Elementary

Chem.	4.	5.	General Chemistry.....	(8)
Biol.	31.	32.	Zoology	(6)
Phys.	12.		Introduction to Physics.....	(3)
Phys.	16.		General Physics	(3)
Biol.	18.		Genetics	(3)
Psych.	1.		Elementary Psychology	(3)
Psych.	24.		Elementary Tests and Measurements.....	(3)

Required Courses: Advanced

Psych.	304.		Social Psychology.....	(3)
Psych.	308.		Child Psychology.....	(3)
Psych.	309.		Abnormal Psychology.....	(3)
Psych.	320.		History of Psychology.....	(3)
Psych.	324.		Intermediate Tests and Measurements.....	(3)
Psych.	327.		Group Testing Techniques.....	(3)
Psych.	329.		Physiological Psychology	(3)
Psych.	335, 336.		Experimental Psychology.....	(6)

Suggested Electives

Phys.	17.		General Physics Laboratory.....	(2)
Phil.	261.		Philosophy of Natural Sciences.....	(3)
Psych.	315.		Projective Techniques	(3)
Psych.	316.		Individual Testing Techniques.....	(3)
Psych.	317.		Personality	(3)
Biol.	3.		Comparative Vertebrate Anatomy	(3)
Biol.	4.		Vertebrate Embryology	(3)

Industrial Psychology: for majors interested in employment, labor relations, and industrial personnel.

Required Courses: Elementary

Chem.	4.	5.	General Chemistry.....	(8)
Biol.	13.		Human Biology	(3)
or				
Biol.	31.	32.	Zoology	(6)
Phys.	12.		Introduction to Physics.....	(3)
Eco.	3.	4.	Economics	(6)
Psych.	1.		Elementary Psychology	(3)
Psych.	24.		Elementary Tests and Measurements.....	(3)

Required Courses: Advanced

Eco.	333, 334.		Labor Problems.....	(6)
I.E.	114.		Plant Administration.....	(3)
I.E.	115.		Personnel Administration.....	(3)
I.E.	328.		Work Simplification	(3)
Psych.	304.		Social Psychology.....	(3)
Psych.	309.		Abnormal Psychology.....	(3)
Psych.	324.		Intermediate Tests and Measurements.....	(3)
Psych.	327.		Group Testing Techniques.....	(3)
Psych.	329.		Physiological Psychology	(3)
Psych.	335, 336.		Experimental Psychology.....	(6)
Psych.	351.		Industrial Training and Work Control.....	(3)
Psych.	354.		Psychological Design Factors.....	(3)

Suggested Electives

Psych.	317.		Personality	(3)
Phil.	261.		Philosophy of Natural Sciences.....	(3)

Preclinical Psychology: for majors intending to go into graduate work in clinical psychology.

<i>Required Courses: Elementary</i>			
Chem.	4,	5.	General Chemistry.....(8)
Biol.	31,	32.	Zoology.....(6)
Phys.	12.		Introduction to Physics.....(3)
Psych.	1.		Elementary Psychology.....(3)
Psych.	24.		Elementary Tests and Measurements.....(3)

<i>Required Courses: Advanced</i>			
Psych.	304.		Social Psychology.....(3)
Psych.	308.		Child Psychology.....(3)
Psych.	309.		Abnormal Psychology.....(3)
Psych.	315.		Projective Techniques.....(3)
Psych.	316.		Individual Testing Techniques.....(3)
Psych.	317.		Personality.....(3)
Psych.	320.		History of Psychology.....(3)
Psych.	324.		Intermediate Tests and Measurements.....(3)
Psych.	327.		Group Testing Techniques.....(3)
Psych.	329.		Physiological Psychology.....(3)
Psych.	335, 336.		Experimental Psychology.....(6)

<i>Suggested Electives</i>			
Soc.	42.		Principles of Sociology.....(3)
Phil.	261.		Philosophy of the Natural Sciences.....(3)

Premedical Psychology: for majors intending to enter medical school, and having a primary interest in training for psychiatry.

<i>Required Courses: Elementary</i>			
Chem.	4,	5.	General Chemistry.....(8)
Chem.	35.		Analytical Chemistry.....(4)
Phys.	12.		Introduction to Physics.....(3)
Phys.	16,	17.	General Physics and Laboratory.....(5)
Biol.	31,	32.	Zoology.....(6)
Biol.	3.		Comparative Vertebrate Anatomy.....(3)
Biol.	4.		Vertebrate Embryology.....(3)
Biol.	18.		Genetics.....(2)
Psych.	1.		Elementary Psychology.....(3)
Psych.	24.		Elementary Tests and Measurements.....(3)

<i>Required Courses: Advanced</i>			
Psych.	304.		Social Psychology.....(3)
Psych.	309.		Abnormal Psychology.....(3)
Psych.	315.		Projective Techniques.....(3)
Psych.	324.		Intermediate Tests and Measurements.....(3)
Psych.	329.		Physiological Psychology.....(3)
Psych.	335, 336.		Experimental Psychology.....(6)
Chem.	150, 151.		Organic Chemistry.....(6)
Chem.	165.		Organic Chemistry Laboratory.....(2)

<i>Suggested Electives</i>			
Psych.	316.		Individual Testing Techniques.....(3)
Psych.	317.		Personality.....(3)

ROMANCE LANGUAGES. Majors are offered in French and Spanish.

French.

<i>Required Courses: Elementary</i>			
Fr.	1,	2.	Elementary French.....(6)
Fr.	11,	12.	Intermediate French.....(6)

Required Courses: Advanced

Eighteen hours from the following of which at least six hours shall be chosen from Fr. 221, 222, 223, 224:

Fr.	13, 14.	Types of French Literature.....	(6)
Fr.	21, 22.	Seventeenth and Eighteenth Centuries French Literature.....	(6)
Fr.	31, 32.	Nineteenth Century French Literature.....	(6)
Fr.	41, 42.	French Oral and Written Composition.....	(6)
Fr.	221.	French Literature before the Seventeenth Century.....	(3)
Fr.	222.	Contemporary French Literature.....	(3)
Fr.	223, 224.	Proseminar	(6)

The student will be expected to complete supplementary reading, the list of which he will receive at the beginning of his major work, and to correlate the knowledge gained in courses and readings through the use of some recommended history of French literature.

Spanish.

Required Courses: Elementary

Span.	1, 2.	Elementary Spanish.....	(6)
Span.	11, 12.	Intermediate Spanish	(6)

Required Courses: Advanced

eighteen hours from the following:

Span.	21.	Introduction to Modern Spanish Fiction.....	(3)
Span.	22.	Introduction to Modern Spanish Drama.....	(3)
Span.	31, 32.	Spanish Conversation and Composition.....	(6)
Span.	221.	Spanish Drama of the Golden Age.....	(3)
Span.	222.	Spanish Fiction of the Golden Age.....	(3)
Span.	223, 224.	Proseminar	(6)
Span.	231, 232.	Spanish-American Literature.....	(6)

In addition to the outside reading and reports required in connection with these courses, the student will be expected to acquire a knowledge of the history of Spanish literature as a whole.

SOCIOLOGY. A major in sociology is designed to provide pre-professional preparation for graduate work in law, social work, social research, the ministry, institutional work, personnel work, teaching, interracial and intercultural work, and civil service appointments with local, state, and federal governmental agencies.

Required Courses: Elementary

Soc.	41.	Cultural Anthropology.....	(3)
Soc.	42.	Principles of Sociology.....	(3)
Eco.	3, 4.	Economics	(6)
Psych.	1.	Elementary Psychology	(3)

Required Courses: Advanced

Soc.	44.	The American Community.....	(3)
Soc.	262.	Social Problems	(3)
Soc.	263.	Introduction to Social Work.....	(3)
Soc.	264.	The Family.....	(3)
Soc.	266.	Population Problems.....	(3)
E.S.	145.	Statistical Method	(3)

ARTS AND SCIENCE

Suggested Electives

Soc.	271, 272.	Readings in Sociology.....	(6)
Biol.	13.	Human Biology	(3)
or			
Biol.	33, 34.	Biology and Organic Evolution.....	(6)
Educ.	1.	Introduction to Education	(3)
Govt.	357.	City Government	(3)
Eco.	333 or 334.	Labor Problems	(3)
Psych.	304.	Social Psychology.....	(3)
Hist.	327, 328.	Development of American Institutions.....	(6)

**The College of
Business Administration**

The College of Business Administration

Administrative Officers

Martin Dewey Whitaker, *President*

Earl Kenneth Smiley, *Vice-President*

Carl Elmer Allen, *Dean of the College of Business
Administration*

Wray Hollowell Congdon, *Dean of Students*

Charles Augustus Seidle, *Director of Admissions*

James Harold Wagner, *Registrar*

James Decker Mack, *Librarian*

The College of Business Administration, which is a member of the American Association of Collegiate Schools of Business, offers a program of study designed to provide thorough and systematic training in the fundamentals of business. More specifically, the College aims to develop in the student an intelligent understanding of business principles, an ability to analyze industrial facts, and habits of thought which will enable him to cope with the problems that increasing executive responsibilities will bring him in later life. Stress is on the building of a sound foundation, since it is the firm belief of the College that no substitute can be furnished for the training and experience provided by actual contact with the complex problems of modern business. Accordingly, the student's interests are best served by equipping him with those fundamental facts and insights which will make it possible for him to profit more readily from practical experience after graduation.

In accordance with this plan of training in fundamentals, the student is required to learn the basic principles that underlie all business. No student is permitted to omit basic work in the principles and problems of economics, economic history, accounting, corporation finance, money and banking, marketing, business law, labor problems, and statistical method, which are essential for a career in all types of business enterprise. This insistence upon an acquaintance with the fundamentals of the broad field not only equips the student with the elementary requisites for a career in a

variety of commercial and industrial enterprises but also gives him an invaluable means of discovering his real abilities and making a sound choice of a profession. A major function of the curriculum in business administration is to aid students in their efforts to discover their best talents, not only those individuals who enter college uncertain of their ultimate objectives but also those whose choice of a future profession or field of business may have been determined already but predicated upon inadequate grounds.

In addition to this principle of a generalized training in business fundamentals, the College regards as important the principle that the training as a whole shall offer an education commensurate with the standards of a university. The curriculum permits no student to devote himself exclusively to business subjects. He must acquire at least a rudimentary acquaintance with the cultural and humanitarian aspects of the world around him, and at least a brief contact with science. Consequently, a large part of the curriculum is devoted to work in liberal and scientific subjects. In the freshman year, only two courses each semester are taken in the College of Business Administration. In the sophomore year, the curriculum offers only one course each semester in business administration. Throughout the entire four years work there is emphasis on the social aspects of the subjects considered. If a student develops alongside his business work a special interest in some such field as languages, mathematics, or science, he is given opportunity, through electives, to pursue his special line.

In view of the breadth of training afforded by the variety of required and elective courses, satisfactory preparation for careers in fields other than commerce and industry is also available to students in the College of Business Administration. This is particularly true of law, for which business curricula of the better type are now recognized as excellent preliminary training. Lehigh University has been included by the leading law schools of the country among the institutions whose business curricula meet their admissions requirements.

Perhaps the most distinctive feature of the work in business administration at Lehigh is the character of the class work. Much of the work of the curriculum is taken in the College of Engineering and the College of Arts and Science, while students of these two divisions in very large numbers avail themselves of the courses given in the College of Business Administration. There is no

segregation of students by colleges, and students in business administration take their courses in competition with students trained in liberal arts and in the exact sciences. This condition has a marked influence on the standards of work and the quality of the student.

Although emphasis is upon broad training, rather than specialization, the College recognizes that some degree of concentration is desirable after the student's interests may reasonably be expected to have crystallized. Accordingly, in the junior and senior years, every student is required to pursue a series of related courses in some more restricted field. Six fields of concentration are offered, viz.: accounting, economics, economic statistics, finance, marketing, and general business. The detailed programs of study in each of the above fields are set forth on the following pages.

In times of normal business activity, students who have made creditable records may reasonably expect to receive one or more offers of positions before the date of their graduation. The College of Business Administration enjoys happy relations with many of the country's leading industries. Representatives regularly visit the campus to engage the services of students graduating in business administration. The University assumes no responsibility for finding positions for its graduates, but every effort is made by the College and by the university placement service to put its graduating students in touch with desirable opportunities for employment.

Graduates of this curriculum receive the degree of Bachelor of Science in Business Administration.

A five-year curriculum in industrial engineering and business administration is outlined on pages 92-94.

A graduate program leading to the degree of Master of Business Administration is outlined on pages 137-139.

THE CURRICULUM IN BUSINESS ADMINISTRATION

Total hours required for Degree of B.S. in Business Administration: 128

I. Required Courses (59 hours)

Course No.	Course Title	Cr. Hrs.	Course No.	Course Title	Cr. Hrs.
Acctg. 1	Accounting	3	Fin. 125	Corporation Finance....	3
Acctg. 2	Accounting	3	Fin. *	Money & Banking.....	3
Eco. 1	Ind. Evolution.....	3	Law 101	Business Law.....	3
Eco. 3	Economics	3	Math. 10	Gen. Math. for Bus....	3
Eco. 4	Economics	3	Math. 40	Math. of Finance	3
Eco. 111	Marketing	3	M.S.A.S. 1	Mil./Air Science	2
Eco. 50	Economic Geography....	3	M.S.A.S. 2	Mil./Air Science	2
Eco. 333	Labor Problems	3	M.S.A.S.	Mil./Air Science	2
Engl. 1	Composition & Lit.....	3	M.S.A.S.	Mil./Air Science	2
or Engl. 11	Types of World Lit....	3	Biol. 15	Freshman Hygiene.....	—
Engl. 2	Composition & Lit.....	3	P.E. 1	Physical Education	—
or Engl. 12	Types of World Lit....	3	P.E. 2	Physical Education	—
E.S. 145	Statistical Method	3	P.E. 3	Physical Education	—
E.S. 346	Business Cycles	3	P.E. 4	Physical Education	—

*Students majoring in accounting, marketing, or general business will take Fin. 133, Money and Banking. Students majoring in economics, economic statistics, or finance will take Fin. 129, Money and Banking.

II. Major Program (24 hours)

Before the end of the second semester of their sophomore year students will select a major or field of concentration. A major program will consist of twenty-four hours of sequential or related courses prescribed by the dean of the College and the head of the department concerned.

III. Optional Courses (33 hours)

ENGLISH OR FOREIGN LANGUAGE OPTION (12 HOURS)

Students who present two units in one foreign language for entrance credit will not be required to take further work in foreign languages. Students who present less than two units of a foreign language for entrance credit will be required to take six hours in one foreign language. Credit for less than six hours in an elementary language will not be accepted in partial satisfaction of this requirement.

All courses offered by the Department of English which require work in composition, either oral or written, or a study of literature will be accepted in satisfaction of this English-Foreign Language requirement. Journalism courses which do not require work in composition or study of literature will not be accepted.

OTHER ARTS OPTIONS (12 HOURS)

The Arts Options requirement may be met by taking a total of twelve hours work in the following fields, not more than six hours to be in any one of the fields designated; astronomy, education, fine arts, government, history, international relations, mathematics, music, philosophy, psychology, religion, sociology.

BUSINESS ADMINISTRATION

SCIENCE OPTION (9 HOURS)

Not more than six hours in the Science Option may be taken in one department. The following courses are acceptable in satisfaction of the science requirement: Biol. 1, 6, 13, or 33 and 34; Geol. 1, or 3 and 4; Chem. 15 and 16; Phys. 12 and 16.

IV. Electives (12 hours)

Any courses in the University for which a student has the prerequisites may be used to meet this requirement.

COURSES OF STUDY

FIRST SEMESTER			FRESHMAN YEAR		SECOND SEMESTER		
Course No.		Course Title	Cr. Hrs.	Course No.		Course Title	Cr. Hrs.
Acctg.	1	Accounting	3	Acctg.	2	Accounting	3
Eco.	1	Ind. Evolution	3	Eco.	50	Economic Geography ..	3
		*English	3			*English	3
Math.	10	Gen. Math. for Bus....	3	Math.	40	Math. of Finance	3
		Foreign Language	} 3			Foreign Language	} 3
		or Arts Option or				or Arts Option or	
		Science				Science	
M.S.A.S.	1	Mil./Air Science	2	M.S.A.S.	2	Mil./Air Science	2
P.E.	1	Physical Education	—	P.E.	2	Physical Education	—
			17				17

*For a statement of the freshman English requirement see "Freshman Composition" under the heading "English" in the section "Description of Courses."

FIRST SEMESTER			SOPHOMORE YEAR		SECOND SEMESTER		
Course No.		Course Title	Cr. Hrs.	Course No.		Course Title	Cr. Hrs.
Eco.	3	Economics	3	Eco.	4	Economics	3
		Engl. (or For.	} 12*			Engl. (or For.	} 12*
		Lang.); Arts Op-				Lang.); Arts Op-	
		tions and Science				tions and Science	
M.S.A.S.	3	Mil./Air Science	2	M.S.A.S.	4	Mil./Air Science	2
P.E.	3	Physical Education	—	P.E.	4	Physical Education	—
			17				17

*Students majoring in accounting will take Acctg. 13 and Acctg. 14, Intermediate Accounting during the sophomore year and defer six hours of this group to subsequent years.

Courses Required of All Students

FIRST SEMESTER			JUNIOR AND SENIOR YEARS		SECOND SEMESTER		
Course No.	Course Title	Cr. Hrs.	Course No.	Course Title	Cr. Hrs.		
E.S. 145	Stat. Method	3	E.S. 346	Bus. Cycles	3		
Eco. 111	Marketing	3	Eco. 333	Labor Problems.....	3		
Fin. *	Money & Banking.....	3	Fin. 125	Corp. Finance	3		
Law 101	Business Law	3		Engl. or For.Lang. }	3		
	Free Electives	6		or Arts Option** }	3		
				Free Electives	6		

NOTE: Eco. 111, Eco. 333, Fin. 133, and Fin. 125 are offered both semesters.

*Finance 129 is required of all students majoring in economics, finance, or economic statistics (see exceptions under this major). Finance 133 is required of all students majoring in accounting, marketing, or general business.

**Normally, a student will not have completed all the options in English or Foreign Language or Arts and will be required to roster a course in one of these fields during the junior or senior years.

LEHIGH UNIVERSITY

Major in Accounting

FIRST SEMESTER		JUNIOR AND SENIOR YEARS				SECOND SEMESTER	
<i>Required Courses in Major*</i>							
Acctg.	13	Intermed. Acctg.....	3	Acctg.	14	Intermed. Acctg.....	3
Acctg.	115	Cost Acctg.	3	Law	102	Business Law	3
				Law	204	Wills Estates & Trusts	3
and nine semester hours to be selected from the following in consultation with the adviser:							
Acctg.	203	Fed. Tax Acctg.	3	Acctg.	218	Adv. Cost Acctg.	3
Acctg.	320	Auditing	3	Acctg.	219	Spec. Acctg. Systems ..	3
				Acctg.	315	Adv. Acctg.....	3
<i>Suggested Electives</i>							
I.E.	162	Ind. Mngmt.	3	Eco.	306	Inter. Eco. Theory	3
Fin.	323	Investments	3	Eco.	301	Bus. Mngmt.	3
Fin.	153	Credits & Col.....	3				
E.S.	352	Adv. Stat. Method.....	3				

Major in Economics

FIRST SEMESTER		JUNIOR AND SENIOR YEARS				SECOND SEMESTER	
Required Courses in Major							
Eco.	307	Adv. Econ.	3	Eco.	334	Labor Problems	3
Fin.	351	Pub. Fin.: Federal	3	Fin.	130	Money & Banking	3
Eco.	306	Inter. Eco. Theory	3				
and nine semester hours to be selected from the following in consultation with the adviser:							
E.S.	347	Nat. Inc. Analysis	3	E.S.	348	Adv. Bus. Cycles	3
Fin.	241	Inter. Trade & Fin	3	Fin.	342	Inter. Trade & Fin	3
Eco.	235	Transportation	3	Eco.	308	Adv. Econ.	3
Eco.	371	Readings in Eco	3	Eco.	236	Public Utilities	3
				Eco.	372	Readings in Eco	3
Suggested Electives							
Acctg.	313	Intermed. Acctg.	3	Phil.	14	Logic & Scient. Meth.	3
Math.	11	Anal. Geom.	3	Math.	12	Calculus I	3
Hist.	327	Dev. Amer. Inst.	3	Hist.	328	Dev. Amer. Inst.	3
Hist.	331	Intel. Expan. Eur.	3	Hist.	332	Intel. Expan. Eur.	3

Major in Economic Statistics

FIRST SEMESTER		JUNIOR AND SENIOR YEARS		SECOND SEMESTER			
Required Courses in Major							
E.S.	347	Nat. Inc. Analysis	3	†Fin.	130	Money & Banking.....	3
Eco.	306	Inter. Eco. Theory	3	E.S.	348	Adv. Bus. Cycles	3
E.S.	352	Adv. Stat. Method or					
E.S.	353	Time Series Analysis..	3				
and nine semester hours to be selected in consultation with the advisers							

*The New York State Board of Certified Public Accountant Examiners requires 8 credit hours of finance for candidates for the C.P.A. examinations in that state. The New Jersey State Board of Public Accountants also requires 8 hours of finance and also 30 hours of accounting for candidates for the C.P.A. examination in that state. It is, therefore, recommended that students who anticipate becoming candidates for the C.P.A. examinations in either of those states take 3 additional credit hours of finance courses and students who anticipate becoming candidates for the C.P.A. examinations in New Jersey also take 6 additional credit hours in Accounting, as a part of their elective program. Lehigh University is registered with both the above boards.

†Students whose primary interest is actuarial science will take Finance 133 instead of Finance 129 and 130, and will be required to select twelve semester hours in consultation with adviser.

BUSINESS ADMINISTRATION

Suggested Electives

Math. 11	Anal. Geom. 3	Math. 12	Calculus I 3
Hist. 327	Dev. Amer. Inst. 3	Math. 340	Higher Algebra 3
Eco. 371	Readings in Eco. 3	Hist. 328	Dev. Amer. Inst. 3
		E.S. 372	Readings in Eco. Stat. 3

Major in Finance

FIRST SEMESTER

JUNIOR AND SENIOR YEARS

SECOND SEMESTER

Required Courses in Major

Fin. 323	Investments 3	Fin. 126	Corp. Finance 3
Fin. 351	Pub. Finance: Fed. 3	Fin. 130	Money & Banking 3
		Eco. 306	Inter. Eco. Theory 3

and nine semester hours to be selected from the following in consultation with the adviser:

Fin. 153	Credits & Collect. 3	Fin. 324	Investments 3
Fin. 232	Mon.-Fiscal Policy 3	Fin. 331	Bank Credit Prob. 3
Fin. 241	Inter. Trade & Fin. 3	Fin. 342	Inter. Trade & Fin. 3
E.S. 347	Nat. Income Anal. 3	Fin. 352	Pub. Finance:
Eco. 301	Bus. Mgmt. 3		State & Local 3
		E.S. 348	Adv. Bus. Cycles 3
		Eco. 160	Insurance 3
		Law 204	Wills, Estates & Trusts 3

Suggested Electives

Acctg. 13	Intermed. Acctg. 3	Acctg. 14	Intermed. Acctg. 3
Eco. 307	Adv. Economics 3	Eco. 308	Adv. Economics 3
Fin. 371	Readings in Fin. 3	Fin. 372	Readings in Fin. 3

Major in Marketing

Required Courses in Major

FIRST SEMESTER

SECOND SEMESTER

Eco. 113	Advertising 3	Eco. 115	Retailing 3
Eco. 235	Transportation 3	Eco. 306	Inter. Eco. Theory 3
Fin. 241	Inter. Trade & Fin. 3	Eco. 214	Sell. & Sales Mgmt. 3

and six semester hours to be selected from the following in consultation with the adviser:

I.E. 162	Ind. Mgmt. 3	Soc. 42	Prin. of Soc. 3
Fin. 153	Credits & Col. 3	Psych. 16	Psych. of Business 3
Acctg. 115	Cost Acctg. 3	Fin. 342	Inter. Trade & Fin. 3
E.S. 347	Nat. Income Anal. 3	Eco. 160	Insurance 3
Eco. 217	Industrial Mkt. 3	Eco. 301	Bus. Mgmt. 3
Eco. 371	Readings in Eco. 3	Eco. 312	Mkt. Research. 3
		Eco. 372	Readings in Eco. 3

Suggested Electives

Engl. 41	Business Letters. 3	Speech 31	Bus. & Prof. Speaking 3
Journ. 43	Writing for Bus. 3		

Major in General Business

FIRST SEMESTER

JUNIOR AND SENIOR YEARS

SECOND SEMESTER

Required Courses in Major

Acctg. 13	Intermed. Acctg. or	*Eco. 113	Advertising or
Acctg. 115	Cost Accounting 3	Eco. 214	Sell. & Sales Mgmt. 3
Eco. 306	Inter. Eco. Theory 3	Fin. 126	Corp. Finance 3
Fin. 351	Pub. Finance: Fed. 3	Law 102	Business Law 3

*Eco. 113, Advertising offered first semester only.

and six semester hours to be selected from the following in consultation with the adviser:

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Acctg.	113	Intermed. Acctg. or	Eco.	160	Insurance	3
Acctg.	115	Cost Accounting	Eco.	308	Adv. Economics	3
E.S.	347	Nat. Income Anal.....	Eco.	236	Public Utilities.....	3
Fin.	153	Credits & Col.....	E.S.	348	Adv. Bus. Cycles	3
Fin.	323	Investments	Fin.	352	Pub. Finance:	
Fin.	241	Inter. Trade & Fin.....			State & Local.....	3
Eco.	113	Advertising or	Eco.	301	Bus. Mgmt.	3
*Eco.	214	Sell. & Sales Mgmt.....				
E.S.	352	Adv. Stat. Meth.....				
Fin.	232	Mon.-Fiscal Policy				
Acctg.	203	Fed. Tax Acctg.....				

Suggested Electives

Eco.	235	Transportation	Eco.	334	Labor Problems	3
I.E.	162	Ind. Mgmt.	Soc.	262	Social Problems.....	3
			I.E.	115	Personnel Adm.....	3
			Soc.	42	Prin. of Soc.....	3

FIVE-YEAR CURRICULUM IN INDUSTRIAL
ENGINEERING AND BUSINESS ADMINISTRATION

Students who desire to pursue both industrial engineering and business administration may complete the required work for the degree of Bachelor of Science in Industrial Engineering by the end of the fourth year and that required for the degree of Bachelor of Science in Business Administration by the end of the fifth year. It is necessary that a student be enrolled in the curriculum in industrial engineering for the first four years and that he complete the requirements in this curriculum as outlined on pages 118 and 119. At the beginning of the fifth year the student transfers to the curriculum in business administration and is required to complete thirty semester hours in one of the following majors:

Major in Accounting

FIRST SEMESTER			FIFTH YEAR			SECOND SEMESTER		
Required Courses								
Law	101	Business Law.....	3	Law	102	Business Law.....	3	
Fin.	133	Money & Banking.....	3	Law	204	Wills, Estates & Trusts	3	
Eco.	333	Labor Problems.....	3	Eco.	111	Marketing	3	
				Acctg.	218	Adv. Cost Acctg.....	3	
and nine semester hours to be selected from the following in consultation with the adviser:								
Acctg.	203	Fed. Tax Acctg.....	3	Acctg.	219	Spec. Acctg. Systems..	3	
Acctg.	320	Auditing	3	Acctg.	315	Adv. Acctg.....	3	

Major in Economics

FIRST SEMESTER			FIFTH YEAR		SECOND SEMESTER		
<i>Required Courses</i>							
Law	101	Business Law.....	3	Eco.	307	Inter. Eco. Theory	3
Fin.	133	Money & Banking.....	3	Eco.	308	Adv. Econ.	3
Eco.	307	Adv. Econ.	3				
Fin.	351	Public Fin.: Federal....	3				

*Eco. 214, Sell. & Sales Mgmt. offered second semester only.

BUSINESS ADMINISTRATION

and twelve semester hours to be selected
from the following in consultation with the adviser:

Eco.	235	Transportation	3	Soc.	42	Sociology	3
Fin.	241	Inter. Trade & Fin.....	3	Eco.	236	Public Utilities	3
E.S.	347	Nat. Income Anal.....	3	Eco.	334	Labor Problems	3
Eco.	371	Readings in Eco.....	3	Fin.	342	Inter. Trade & Fin.....	3
E.S.	352	Adv. Stat. Method.....	3	E.S.	348	Adv. Bus. Cycles.....	3
E.S.	353	Time Series Analysis..	3	Soc.	262	Social Problems.....	3
				Eco.	372	Readings in Eco.....	3

Major in Economic Statistics

FIRST SEMESTER

FIFTH YEAR

SECOND SEMESTER

Required Courses

Law	101	Business Law	3	Eco.	306	Inter. Eco. Theory.....	3
Fin.	133	Money & Banking.....	3	E.S.	348	Adv. Bus. Cycles	3
E.S.	347	Nat. Income Anal.....	3				
E.S.	352	Adv. Stat. Method or					
E.S.	353	Time Series Analysis..	3				

and twelve semester hours to be selected
in consultation with the adviser

Major in Finance

FIRST SEMESTER

FIFTH YEAR

SECOND SEMESTER

Required Courses

Law	101	Business Law	3	Fin.	126	Prob. in Corp. Fin.....	3
Fin.	133	Money & Banking.....	3	Eco.	306	Inter. Eco. Theory.....	3
Fin.	323	Investments	3				
Fin.	351	Public Fin.: Federal....	3				

and twelve semester hours to be selected
from the following in consultation with the adviser:

Fin.	153	Credits & Col.....	3	Eco.	160	Insurance	3
Fin.	241	Inter. Trade & Fin.....	3	Fin.	342	Inter. Trade & Fin.....	3
Eco.	235	Transportation	3	Fin.	324	Investments	3
Acctg.	13	Intermed. Acctg.....	3	Fin.	352	Public Finance:	
Fin.	371	Readings in Fin.....	3			State & Local.....	3
Fin.	232	Mon.-Fiscal Policy	3	Eco.	236	Public Utilities	3
Bus.	301	Bus. Mgmt.....	3	Acctg.	14	Intermed. Acctg.....	3
				Fin.	372	Readings in Fin.....	3

Major in Marketing

FIRST SEMESTER

FIFTH YEAR

SECOND SEMESTER

Required Courses

Law	101	Business Law	3	Eco.	115	Retailing	3
Fin.	133	Money & Banking.....	3	Eco.	306	Inter. Eco. Theory.....	3
Eco.	113	Advertising	3	Eco.	214	Sell. & Sales Mgmt.....	3

and twelve semester hours to be selected
from the following in consultation with the adviser:

Fin.	153	Credits & Col.....	3	Eco.	160	Insurance	3
Fin.	241	Inter. Trade & Fin.....	3	Fin.	342	Inter. Trade & Fin.....	3
Eco.	235	Transportation	3	Acctg.	218	Adv. Cost Acctg.....	3
Eco.	371	Readings in Eco.....	3	Eco.	372	Readings in Eco.....	3
Eco.	217	Industrial Mkt.....	3	Eco.	301	Bus. Mgmt.....	3
				Eco.	312	Mkt. Research.....	3
				Soc.	42	Sociology	3

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Major in Personnel and Industrial Relations

FIRST SEMESTER		FIFTH YEAR				SECOND SEMESTER	
<i>Required Courses</i>							
Law	101	Business Law.....	3	Eco.	306	Inter. Eco. Theory.....	3
Fin.	133	Money & Banking.....	3	Eco.	334	Labor Problems.....	3
Psych.	351	In. Tr. & Work Control.....	3	Soc.	42	Sociology	3
and twelve semester hours to be selected from the following in consultation with the adviser:							
Fin.	323	Investments	3	Law	102	Business Law	3
Fin.	351	Public Fin.: Federal....	3	Eco.	160	Insurance	3
Fin.	241	Inter. Trade & Fin.....	3	Psych.	352	Ind. Select. & Class....	3
E.S.	347	Nat. Income Anal.....	3	Govt.	360	Pub. Adm.....	3
Eco.	371	Readings in Eco.....	3	Soc.	262	Social Problems.....	3
E.S.	352	Adv. Stat. Method.....	3	Eco.	372	Readings in Eco.....	3
E.S.	353	Time Series Analysis..	3	I.E.	115	Personnel Administr....	3
				Eco.	301	Bus. Mgmt.	3

**The College of
Engineering**

The College of Engineering

Administrative Officers

Martin Dewey Whitaker, *President*

Earl Kenneth Smiley, *Vice-President*

Loyal Vivian Bewley, *Dean of the College of Engineering*

Wray Hollowell Congdon, *Dean of Students*

John Douglas Leith, *Associate Dean of Students*

Charles Augustus Seidle, *Director of Admissions*

James Harold Wagner, *Registrar*

The College of Engineering offers curricula in chemical engineering, chemistry, civil engineering, electrical engineering, engineering physics, general science and mathematics, industrial engineering, mechanical engineering, metallurgical engineering, and mining engineering. Five-year courses combining the liberal arts and engineering, business administration and industrial engineering, electrical and mechanical engineering, electrical engineering and physics are also provided. In each of these combined curricula one baccalaureate degree is awarded upon the successful completion of four years of study, and a second baccalaureate degree is awarded at the end of the fifth year.

The engineering curricula were formulated on the basis of an intense study, by the faculty of Lehigh University, of the problems of technical education and the changing needs of modern industry. This study led to the conclusion that greater emphasis than heretofore should be placed upon the fundamentals of engineering, including mathematics, physics, chemistry, and theoretical and applied mechanics, and less emphasis upon the highly specialized details of engineering practice; and that the engineer must know something of the social sciences, that is, the sciences which deal with human relations, and be familiar with the methods of business organization and administration. The various engineering curricula accordingly emphasize the fundamental sciences and those subjects from the social sciences and the humanities which are part of the equipment of every well-educated man. These latter are now recognized as essential to the proper training of

engineers not only because of their practical applications in industrial, business, and civic life, but also because they enrich the whole of a man's private life.

Provision is made for a uniform freshman year in the College of Engineering. The student's tentative choice of a specialized engineering curriculum, as recorded at the time of entrance, may be changed (within the limitations of enrollment in the various curricula) prior to his entering upon the sophomore year, without loss of time. Engineering freshmen are admitted with "open" curriculum choice. Within a year of college experience, and on the basis of conference with members of the faculty, it is hoped that any student who is uncertain as to his specialized curriculum choice may choose wisely. In the second semester of his freshman year, just prior to preregistration for the sophomore year, each engineering student must select a particular engineering curriculum.

The work of the first two years is fairly self-contained. To those who for one reason or another are unable to complete their engineering training, it affords preparation for careers as draftsmen, electricians, surveyors, shop foremen, or assistants in industrial laboratories or plants.

Since the University recognizes that an engineer can not be trained by purely academic process, the degree awarded upon graduation is Bachelor of Science in the particular division of engineering that has been studied, for example, Bachelor of Science in Civil Engineering. The successful completion of one year of full-time graduate study leads to the degree of Master of Science. Professional degrees are conferred after five years of acceptable experience, as noted below.

General Studies

General studies are non-professional, non-specialized studies in the large areas of human knowledge and experience with which any educated man should be acquainted. These areas are three: the humanities, the natural sciences, and the social sciences. Since all engineers receive extensive training in the physical sciences, their general studies are restricted to life and earth sciences, the humanities and the social sciences. A carefully developed program strengthening the earlier offerings in this area was approved by the University Faculty in the fall of 1953.

The general studies sequence starts in the freshman year with a study of English composition and literature and a study of history in the course "Development of Western Civilization." It continues with a broad course in economics, including its social aspects, which extends throughout the sophomore year. This is followed by two courses selected from alternates, which are usually taken in the junior year. The first of these alternates is either biology or psychology, and the second either philosophy or literature. The first acquaints the student with an important life science, and the second strengthens his background in the humanities. The final two courses are elected by the student, under the guidance of his curriculum director, from at least two of the eight elective groups shown in the accompanying table.

Several of these required or elective courses (notably History 11 and 12, "Development of Western Civilization"; Biology 13, "Human Biology"; Psychology 12, "Introduction to Psychology"; and Philosophy 100, "Philosophy of Contemporary Civilization") have been developed particularly for this program. They are designed to help it in its major aims: first to acquaint the student with that literary, social, political, and economic background which is our heritage, and second, to open intellectual doors in his mind and thus give him a sound start on self-education which will continue throughout his life.

The objective of the study of the humanities and the social sciences in technical schools has been stated by the American Society for Engineering Education to be the development of an "understanding of the evolution of the social organism within which we live . . .; and the development of moral, ethical and social concepts essential to a satisfying personal philosophy, to a career consistent with the public welfare, and to a sound professional attitude." We conceive it to be the duty of the engineer to be a professional man in the broadest sense of the term, a member of a group whose primary aim is to advance human well-being.

General Studies Courses

Required Courses:

English 1 and 2	Composition and Literature.....	(6)
History 11 and 12	Development of Western Civilization.....	(6)
Economics 3 and 4	Economics	(6)

Alternate Courses:

Biology 13	Human Biology or	
Psychology 12	Introduction to Psychology.....	(3)
Philosophy 100	Philosophy of Contemporary Civilization, or	
Literature	In a foreign language or in English (see Group 4).....	(3)

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Elective Course Groups:

Not more than 3 hours from any one group

Group 1:	Biology 6, 13; Geology 1, 6; Astronomy 1; Psychology 12, 309, 351
Group 2:	Greek 21, 183, 202; Latin 22, 184, 203; History, any course other than History 11-12.
Group 3:	Economics 306, 307, 308, 333, 334; Sociology 41, 42, 262, 266
Group 4:	Literature course in a foreign language or in English (English 4, 5, 7, 8, 9, 11, 12, 18, 19, 20, 21, 36, 117, 323, 324.)
Group 5:	Speech 30, or English 42, or a foreign language beyond the first year.
Group 6:	Fine Arts, any course; Music 13, 14
Group 7:	Philosophy or Religion, any course.
Group 8:	Government or International Relations, any course.

The Uniform Freshman Year

An outline follows of the work of the freshman year, uniform for all engineering students. For schedules of the work of the upper three years, varying according to the several specialized curricula, see the subsequent pages.

FIRST SEMESTER			FRESHMAN YEAR		SECOND SEMESTER		
Course No.	Course Title	Cr. Hrs.	Course No.	Course Title	Cr. Hrs.		
Chem. 4	Gen. Chemistry	4	Chem. 5	Gen. Chemistry	4		
*Engl. 1	Composition & Lit.....	3	*Engl. 2	Composition & Lit.....	3		
Hist. 11	Dev. W. Civilization ..	3	Hist. 12	Dev. W. Civilization ..	3		
†Math. 11	Anal. Geom.	3	Math. 12	Calculus I.....	3		
Phys. 22	Mech. & Prop. of		C.E. 61	Eng. Draw.....	3		
	Matter	4	Phys. 22	or Mech. & Prop			
C.E. 61	or Engr. Draw.....	3		of Matter.....	4		
M.S.A.S. 1	Mil./Air Science.....	2	M.S.A.S. 2	Mil./Air Science.....	2		
P.E. 1	Physical Education.....	—	P.E. 2	Physical Education.....	—		
18 or 19			18 or 19				

Inspection Trips

Inspection trips to industrial plants are a required part of specific courses in the various curricula in engineering. Written reports or examinations are required. These trips are under the general direction and supervision of the faculty committee on inspection trips. They are generally held during the senior year and involve an average expense of about \$25.00. The location of the University in the center of industrial activities of various types furnishes unusual opportunities for visits of inspection to engineering plants.

*Engl. 1 and 2, Composition and Literature, are the courses normally taken in the first and second semesters respectively of the freshman year. Students who demonstrate superior ability in composition on the English placement tests are assigned to Engl. 11 and 12, Types of World Literature. Those whose performance is regarded as unsatisfactory are required to complete successfully Engl. 0, Elementary Composition, followed by Engl. 1 and 2.

†Students whose performance on a Mathematics Placement Test is regarded as unsatisfactory are required to complete successfully Math. 0, Mathematics Review, before entering Math. 11.

Combined Arts and Engineering Curricula

Under the five-year plan the student registers in the College of Arts and Science for four years, earning the B.A. degree on completion of a program which includes, along with specific B.A. training, the fundamental mathematical, scientific, and engineering subjects of the engineering curriculum of his choice. The fifth year is spent in the College of Engineering, carrying on a program leading to the degree of B.S. in his selected branch of engineering. This is usually the senior year curriculum of the chosen branch of engineering.

An engineering student who decides at any stage of his course that he wishes to work for both the B.A. and B.S. degrees, may register in one of the colleges concerned for a period of years and complete the combined requirements of both degrees in five or six years, depending upon the program followed before the decision is made. His curriculum is so arranged that the work for one degree may be finished at the end of a four-year period, and the work for the subsequent degree at the close of the fifth or sixth year.

Cooperative Programs With Industry

Lehigh University has entered into agreements with the Philco Corporation and the Pennsylvania Power and Light Company (and agreements with other companies are pending), whereby undergraduate students in various branches of engineering may pursue an interleaved course of study and industrial employment, comprising 8 semesters of study at Lehigh University, and 3 periods (each approximately equal to a semester in length) of employment in industry, totaling 4 calendar years, at the successful completion of which the student will receive a B.S. degree from Lehigh University and a suitable certificate from the industrial concern.

The objective of a cooperative program is: To give the student an opportunity to become familiar with industrial methods, policies, and environment to the end that he will acquire a greater degree of motivation towards his academic studies.

The scope of the academic part of a cooperative program is identical with that of the standard curriculum in which the student is registered. Exactly the same courses are taken and in substantially the same sequence.

The first industrial employment period commences at the end of the sophomore year. The third, or final, period follows the end of the senior year. The degree is conferred upon the completion of the senior year. Students electing a cooperative program are expected to complete it.

During the three periods of industrial employment the student is closely supervised to guarantee that he acquires a balanced training in industrial practice. Representatives from the University make periodic inspections of the industrial training part of the program for the purpose of assuring that this training is in keeping with the above objectives, and that the student is receiving maximum benefits from the cooperative program. The student is required to render a comprehensive report on his observations and work while employed in industry.

While engaged in industrial employment the student is paid at prevailing rates for the type of work in which he is engaged.

There is no obligation, either legal or moral, on the part of the student to agree to accept permanent employment with the industrial concern with which he is connected on a cooperative program; nor is there any obligation on the part of the industrial concern to offer him permanent employment.

The details of cooperative programs vary with different curricula and industrial organizations. Interested students should consult their curriculum director. A typical 4-year program between Electrical Engineering and the Philco Corporation, which comprises 11 approximately equal periods, is as follows:

FALL SEMESTER	SPRING SEMESTER	SUMMER SEMESTER
1. Freshman I	2. Freshman II	Vacation
3. Sophomore I	4. Sophomore II	5. Philco Corp.
6. Junior I	7. Philco Corp.	8. Junior II
9. Senior I	10. Senior II	11. Philco Corp.

During Period 7, while the student is with Philco Corporation, an evening course in Industrial Electronics (E.E. 110) is required.

Students interested in such a program should apply to their curriculum director not later than the middle of the semester preceding the first scheduled period with industry.

Professional Engineering Degrees

Graduates of the various technical curricula of Lehigh University with the degree of Bachelor of Science in Civil Engineering, Mechanical Engineering, Electrical Engineering, Metallurgical Engineering, Mining Engineering, Chemical Engineering, and Indus-

trial Engineering, may be candidates for the corresponding professional degrees, namely, Civil Engineer (C.E.), Mechanical Engineer (M.E.), Electrical Engineer (E.E.), Metallurgical Engineer (Met.E.), Engineer of Mines (E.M.), Chemical Engineer (Ch.E.), and Industrial Engineer (I.E.). To qualify for a professional degree, a candidate must submit evidence of having had, since graduation, at least five years of acceptable experience in the field of engineering corresponding to the degree desired, and must submit also an acceptable thesis, the subject of which must be approved in advance by the department concerned. In exceptional cases, publications of a high order of merit may be accepted in lieu of a formal thesis. Should the degree applied for not correspond in subject matter to the candidate's undergraduate training, evidence must be furnished that any scholastic deficiency has been satisfied.

Graduates of Lehigh University with the degree of Master of Science in one of the engineering fields may be candidates for the appropriate professional degrees on the same basis as holders of a baccalaureate degree. A candidate who has had a year of acceptable graduate work at Lehigh or elsewhere may count the graduate year toward the partial satisfaction of the requirement of five years of acceptable experience.

Declaration of candidacy for professional degrees must be made on or before October 1 of the year in which the candidate expects to receive his degree. Application blanks may be obtained from the registrar. The thesis must be submitted in duplicate (one copy for the department and one for the University Library) on or before April 15 and should be sent directly to the department concerned. Formal application for a professional degree, accompanied by the required fee, must be made before May 15 of the year in which the degree, is to be conferred. The fee for such a degree is \$50.00. Professional degrees are conferred only in June.

THE CURRICULUM IN CHEMICAL ENGINEERING

Graduates in chemical engineering are expected to develop competence in all phases of the work conducted by manufacturing establishments in which chemical and certain physical changes of materials are accomplished during the manufacturing processes. The various phases of this work are research, development, design, construction, operation, plant management, and sales. A small number of the industries that utilize such processes are atomic energy, petroleum and petro-chemicals, rubber, soap and foods in addition to the generally recognized chemical industries.

Preparation for this broad field requires a sound background in the fundamental sciences of Physics, Chemistry and Mathematics plus a general background in engineering principles and intensive training in the application of these fundamentals to carrying forward into industrial production the new products and processes discovered in the laboratory. This latter training is directly called Chemical Engineering. In accord with this philosophy, the student is not trained for any specific industry, but the education is sufficiently broad that a graduate is competent in any of the chemical and allied industries.

The aim of the curriculum is to develop expertness in the sciences, the processes and the unit operations which must be integrated into a chemical manufacturing operation. Some familiarity with factory methods under actual working conditions is acquired through contact with operations in nearby plants. Frequent visits for observation and report are made to manufacturing plants in the immediate vicinity and nearby centers of activity in the chemical industry.

The program is also designed to prepare a student for graduate study in Chemical Engineering. Further study at the graduate level leading to advanced degrees is highly desirable in preparation for careers in the more highly technical aspects of manufacturing. The increasing complexity of modern manufacturing methods requires superior training for men working in the research and development fields or for teaching. By proper election of technical option courses, the graduate can prepare for graduate study in Chemistry.

ENGINEERING

THE CURRICULUM IN CHEMICAL ENGINEERING

FIRST SEMESTER

FRESHMAN YEAR

SECOND SEMESTER

(37 hrs.)

See page 100

FIRST SEMESTER

SOPHOMORE YEAR

SECOND SEMESTER

<i>Course No.</i>	<i>Course Title</i>	<i>Cr. Hrs.</i>	<i>Course No.</i>	<i>Course Title</i>	<i>Cr. Hrs.</i>
Met. 63	Eng. Mat. & Proc.....	3	Ch.E. 70	Ind. Stoichiometry	3
Chem. 35	Analytical Chem.....	4	Chem. 36	Analytical Chem.....	4
Eco. 3	Economics	3	Eco. 4	Economics	3
Math. 13	Calculus II.....	3	Math. 14	Calculus III.....	3
Phys. 23	Heat, Sound & Light..	4	Phys. 24	Elect. & Magnetism....	4
M.S. 13 or			M.S. 14 or		
A.S. 3	Mil./Air Science	2	A.S. 4	Mil./Air Science	2
P.E. 3	Physical Education	—	P.E. 4	Physical Education	—
		19			19

FIRST SEMESTER

JUNIOR YEAR

SECOND SEMESTER

Ch.E. 171	Unit Operations I.....	3	Ch.E. 172	Unit Operations II	3
Chem. 94	Phys. Chemistry.....	3	Ch.E. 200	Ch.E. Thermo.....	3
Chem. 92	Phys. Chem. Lab.....	1	Chem. 191	Phys. Chemistry.....	3
Chem. 150	Organic Chemistry	3	Chem. 192	Phys. Chem. Lab.....	1
Chem. 165	Org. Chem. Lab.....	2	Chem. 151	Organic Chemistry	3
Mech. 3	Statics & Dynamics.....	3	Chem. 179	Lit. of Chem.....	1
	*General Study	3		*General Study	3
		18			17

SUMMER

Ch.E. 100, Eight (8) weeks industrial employment with report.

FIRST SEMESTER

SENIOR YEAR

SECOND SEMESTER

Ch.E. 173	Unit Operations III.....	2	Ch.E. 174	Plant & Equip. Des.....	3
Ch.E. 177	Unit Ops. Lab.....	2	Ch.E. 175	Ch. Engr. Practice.....	1
E.E. 160	Elec. Cir. & Appar.....	3	Ch.E. 176	†Ch.E. Projects.....	2
E.E. 161	Elec. Problems.....	1	Mech. 111	Mech. of Materials ...	3
E.E. 162	Dynamo Lab.....	1	M.E. 333	Power Plants	3
	†Technical Options.....	6		†Technical Options.....	3
	*General Study	3		*General Study	3
		18			18

‡Approximately half the class will be scheduled for Ch.E. 176 in the fall semester.

†The technical options must include one of the following pairs of courses and the third course should be selected from this listing: Ch.E. 301, and 302; Chem. 334, 335, 344 and 345; Chem. 357 and 358 (students expecting to use this option are urged to elect Chem. 167 in their Junior year); Chem. 302 and Ch.E. 386; Phys. 268 and Math. 206, I.E. 164 and M.E. 334; Law 101 and Acct. 104; Eco. 111 and Eco. 214.

*For an elucidation of this requirement see page 98.

THE CURRICULUM IN CHEMISTRY

Chemists constitute nearly one-half of all professional research personnel in industry as shown by a report of the National Resources Planning Board. The American Chemical Society, which requires professional training and experience for eligibility, has a present membership of about 70,000. The consistently rapid increase in the membership of this society in recent years may be taken as an index of the expanding opportunities in the chemical profession.

The curriculum in chemistry provides a thorough grounding in the fundamentals of this science, with the requisite collateral training in physics and mathematics, and gives some consideration to industrial and engineering principles. As a curriculum in the engineering school leading to a bachelor of science degree the fundamentals of chemistry as well as engineering are stressed. In addition to the liberal allotment of time to courses in English, German, economics, history and other non-professional studies, provision is made for twelve semester hours (ordinarily four courses) of professional electives in a minor field of concentration. The tabulation below indicates some of the possibilities of this guided selection of elective courses.

PREPARATION FOR	ELECTIVE SEQUENCE IN
Executive or sales departments of chemical industry	Business administration
Plant operation	Chemical Engineering
Food and pharmaceutical industries	Biochemistry and bacteri- ology
Medicine	Biology
Graduate study or research in physical chemistry	Physics and mathematics
Teaching, especially in public schools	Education
Metals industries	Metallurgy

Since the freshman year of this curriculum is identical with that of chemical engineering, and the sophomore years in the two curricula are nearly the same, it is possible for the student to transfer from one curriculum to the other before the beginning of

the junior year without a considerable sacrifice of credits. In a transfer from chemical engineering to chemistry, the extra courses may be utilized as electives.

Seniors in the curriculum in chemistry may arrange to make the supervised visits to industrial plants which are required in the curriculum in chemical engineering.

THE CURRICULUM IN CHEMISTRY

FIRST SEMESTER			FRESHMAN YEAR			SECOND SEMESTER		
			See page 100					
FIRST SEMESTER			SOPHOMORE YEAR			SECOND SEMESTER		
Course No.	Course Title	Cr. Hrs.	Course No.	Course Title	Cr. Hrs.	Course No.	Course Title	Cr. Hrs.
Chem. 35	Analytical Chem.	4	Chem. 36	Analytical Chem.	4	Chem. 36	Analytical Chem.	4
Eco. 3	Economics	3	Eco. 4	Economics	3	Eco. 4	Economics	3
†Ger. 1 or 3	German	3	†Ger. 2 or 4	German	3	†Ger. 2 or 4	German	3
Math. 13	Calculus II.....	3	Math. 14	Calculus III.....	3	Math. 14	Calculus III.....	3
Phys. 24	Elec. & Magnetism.....	4	Phys. 23	Heat, Sound & Light.....	4	Phys. 23	Heat, Sound & Light.....	4
M.S.A.S. 3	Mil./Air Science.....	2	M.S.A.S. 4	Mil./Air Science.....	2	M.S.A.S. 4	Mil./Air Science.....	2
P.E. 3	Physical Education.....	—	P.E. 4	Physical Education.....	—	P.E. 4	Physical Education.....	—
			19			19		

FIRST SEMESTER			JUNIOR YEAR			SECOND SEMESTER		
Chem. 91	Physical Chemistry	3	Chem. 151	Organic Chemistry	3	Chem. 151	Organic Chemistry	3
Chem. 92	Phys. Chem. Lab.....	1	Chem. 167	Org. Chem. Lab.....	2	Chem. 167	Org. Chem. Lab.....	2
Chem. 150	Organic Chemistry	3	Chem. 356	Quant. Org. Anal.....	1	Chem. 356	Quant. Org. Anal.....	1
Chem. 165	Org. Chem. Lab.....	2	Chem. 190	Physical Chemistry	3	Chem. 190	Physical Chemistry	3
†Ger. 7	Scientific German	3	Chem. 192	Phys. Chem. Lab.....	1	Chem. 192	Phys. Chem. Lab.....	1
	*General Study	3	Ch.E. 160	Ind. Eng. Chem.....	3	Ch.E. 160	Ind. Eng. Chem.....	3
	Elective	3		*General Study	3		*General Study	3
			18			19		

SUMMER

Chem. 100, Eight (8) weeks industrial employment with report.

FIRST SEMESTER			SENIOR YEAR			SECOND SEMESTER		
Chem. 302	Inorganic Chem.....	3	Chem. 175	Research Lab.....	3	Chem. 175	Research Lab.....	3
Chem. 357	Qual. Org. Anal.....	3	Chem. 337	Adv. Analyt. Chem.....	3	Chem. 337	Adv. Analyt. Chem.....	3
Chem. 194	Phys. & El'trochem.....	3	Chem. 179	Hist. & Lit. Chem.....	1	Chem. 179	Hist. & Lit. Chem.....	1
Chem. 197	Electrochem Lab.....	1	Chem. 358	Adv. Org. Chem. }	3	Chem. 358	Adv. Org. Chem. }	3
	*General Study	3	Chem. 371	or Elem. Biochem. }	3	Chem. 371	or Elem. Biochem. }	3
	Elective	3		*General Study	3		*General Study	3
			16			16		

*For an elucidation of this requirement see page 98.

†Students in this curriculum are required to pass Ger. 7, Scientific German. Those who are able to omit one or both semesters of the courses prerequisite to Ger. 7 will elect other courses as substitutes.

THE CURRICULUM IN CIVIL ENGINEERING

The purpose of this curriculum is to give instruction in those general and scientific subjects which form the foundation of all engineering, and a special training in the field of civil engineering, which includes the planning and building of highways, airports, railroads, harbors, docks and terminals, bridges, buildings, subways, tunnels, water supply and purification plants, sewerage systems and sewage disposal plants, water power developments, the making of surveys and research.

Many Civil Engineers are associated with consulting engineering firms, contractors, industrial concerns or governmental subdivisions, and are engaged in the conception, design, construction, and operation of private and public projects.

The work of the first three years deals chiefly with the scientific and mathematical basis of engineering practice, with emphasis upon the application of these principles during the fourth year. All students receive instruction in surveying, highway engineering, geology, structural theory and design foundation engineering, hydraulics, and sanitary engineering. Through the use of approved electives, the student may pursue further work in structural, hydraulic, transportation, or sanitary engineering. Opportunity is provided through an elective for a student to determine whether he has an interest in and aptitude for research. Development of abilities in self-expression are stressed throughout the curriculum.

Instruction in the theory and practice of surveying is given during a six-week Summer Session.

Special 5-year combined programs leading to the degrees B.S. in C.E. and either B.A., B.S. in Bus. Adm. or B.S. in M.E. or E.M. can be arranged.

Recently there came a great increase in the insistence of engineers, through their professional societies, that the engineering student be trained as a professional man, rather than a technician, with a sound understanding of his place in society. This training is provided by the humanistic-social courses extending through the four years and selected with the advice and approval of the curriculum director.

THE CURRICULUM IN CIVIL ENGINEERING

FIRST SEMESTER

FRESHMAN YEAR

SECOND SEMESTER

See page 100

SUMMER

C.E. 40 Land & Topographic Surveying	(3)
C.E. 41 Route Surveying	(3)

FIRST SEMESTER

SOPHOMORE YEAR

SECOND SEMESTER

Course No.	Course Title	Cr. Hrs.	Course No.	Course Title	Cr. Hrs.
Eco. 3	Economics	3	Eco. 4	Economics	3
Math. 13	Calculus II.....	3	Math. 14	Calculus III	3
Mech. 1	Statics	3	Mech. 2	Dynamics	3
Phys. 24	Elec. & Magnetism.....	4	Phys. 23	Heat, Sound & Light.....	4
C.E. 42	Highway Engineering..	3		Approved Elective.....	3
M.S.A.S. 3	Mil./Air Science.....	2	M.S.A.S. 4	Mil./Air Science.....	2
P.E. 3	Physical Education.....	—	P.E. 4	Physical Education.....	—
		18			18

FIRST SEMESTER

JUNIOR YEAR

SECOND SEMESTER

Mech. 111	Mech. of Materials....	3	C.E. 150	Structural Analysis	4
Mech. 115	Materials Test. Lab....	1	Geol. 6	Engr. Geology	4
E.E. 160	Elect. Circ. & Ap.....	3	Mech. 121	Mech. of Fluids	3
E.E. 161	Electrical Problems....	1	Mech. 123	Hydraulic Lab.....	1
E.E. 162	Dynamo Lab.....	1	Mech. 112	Adv. Mech. of Mat.....	3
M.E. 160	Heat Engines	3		*General Study	3
	Approved Elective.....	3	P.E. 6	Physical Education.....	—
	*General Study	3			—
P.E. 5	Physical Education.....	—			—
		18			18

SUMMER

C.E. 100, Industrial Employment

FIRST SEMESTER

SENIOR YEAR

SECOND SEMESTER

C.E. 151	Structural Theory	3	C.E. 102	Froseminal	1
C.E. 153	Reinf. Conc. Theory....	3	C.E. 101	Foundations	2
C.E. 350	Adv. Struct. Anal.....	3	C.E. 152	Structural Design	3
C.E. 160	Water Works Engrg....	3	C.E. 353	Reinf. Conc. Des.	3
	†Adv. Civil Engrg.....	3	C.E. 161	Sewage Works Engrg....	3
	*General Study	3		†Adv. Civil Engrg....	3
P.E. 7	Physical Education.....	—		*General Study	3
		—	P.E. 8	Physical Education.....	—
		18			18

†Any course listed below and approved by the curriculum director.

C.E. 103	Special Problems	2-4	C.E. 321	Hydraulic Machinery ..	3
C.E. 104	Readings in C.E.....	1-3	C.E. 139	Soil Mechanics.....	3
C.E. 107	Structural Welding.....	1	C.E. 351	Structural Design	2
C.E. 140	Transportation Engrg..	3	C.E. 360	Sanitation	3
C.E. 320	Hydraulic Engineering	3	Mech. 321	Inter. Fluid Mech.....	3

*For an elucidation of this requirement see page 98.

THE CURRICULUM IN ELECTRICAL ENGINEERING

The electrical engineer is one who practices the science and art of economically "directing the sources of electrical power in nature for the uses and conveniences of man." He may design, manufacture, install, or operate electrical machinery and equipment, manage plants and electric systems, or engage in the promotion of engineering projects.

The object of this curriculum is to give instruction in those general and scientific subjects which underlie all the branches of engineering, and to give special training in those technical subjects which experience shows are most essential in the equipment of the electrical engineer. In seeking to accomplish this object the department puts chief emphasis upon mastery of the mathematical-physical principles and thoroughness in the analysis of problems.

The curriculum provides a balanced allotment of time in each of four principal divisions: (1) mathematics and the basic sciences, (2) electrical engineering, (3) allied branches of engineering, and (4) non-technical subjects in arts and business. In order to make maximum use of the available time, the electrical courses are highly coordinated with respect to classroom and laboratory work; concurrent courses are designed to augment and supplement each other; and consecutive courses to extend and build upon the previous courses.

In recognition of different talents and inclinations among individuals, and of specialization in industry, three separate options are offered in the senior year: (1) the Power Option for those interested in the technical aspects of design, operation, and development of electrical machinery and power systems; (2) the Communications Option for those interested in the technical aspects of wire or radio communication; and (3) the General Option for those less interested in technical applications and more inclined toward commercial, managerial and operation assignments. The work of the first three years and some of that in the senior year is identical for each option; so that all graduates will have had the same basic work. Thus, although a student elects a particular option, he has a foundation, sufficiently fundamental to enable him to enter any branch of electrical engineering.

SECOND SEMESTER

SECOND SEMESTER

18

SECOND SEMESTER

18

E.E. 100. Industrial Employment

SECOND SEMESTER

*General Study	3
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E.E.	108	Alt. Cur. Mach.....	3	E.E.	331	Elec. & Mag. Fields.....	3
E.E.	109	A.C. Mach. Lab.....	2	E.E.	334	Trans. Line Trans.....	3
E.E.	332	Elec. Transients.....	3	E.E.	336	System Stability.....	3
E.E.	133	Transmission Lines.....	3	E.E.	337	Adv. Mach. Theory.....	3
E.E.	335	Symmetrical Comp.....	3	E.E.	338	Transients Lab.....	1

E.E.	108	Alt. Cur. Mach.....	3	E.E.	331	Elec. & Mag. Fields.....	3
E.E.	109	A.C. Mach. Lab.....	2	E.E.	142	Radio Commun.....	3
E.E.	141	Radio Commun.....	4	E.E.	144	Wire Commun.....	3
E.E.	143	Wire Commun.....	3	E.E.	345	Electromag. Theory.....	3
E.E.	332	Elec. Transients.....	3				

E.E.	108	Alt. Cur. Mach.....	3	Acctg.	104	Accounting	3
E.E.	109	A.C. Mach. Lab.....	2			Elective	3
E.E.	133	Transmission Lines.....	3	E.E.	120	Ind. Application	4
E.E.	332	Transients	3	Fin.	125	Corp. Finance	3
E.E.	335	Symmetrical Comp.....	3				

17 or 18

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THE CURRICULUM IN ENGINEERING PHYSICS

The curriculum in engineering physics is designed to prepare men for careers in scientific work. Primary emphasis is placed on the fundamental principles of physics, and this is carefully coordinated with thorough laboratory training. The first two years of work are similar to those in any of the engineering curricula, and some further engineering study is required in addition to the work in physics during the final two years. The training is thus consciously practical.

The complete curriculum is not dictated. A liberal number of electives, particularly in the senior year, provides unusual flexibility in allowing the curriculum to be adopted to the needs and interests of the individual student. Those whose interests lie in the theoretical or analytical phases of their science, or who are preparing for graduate study, usually elect additional courses in mathematics and physics. Many others elect additional work in chemistry, engineering, geophysics, education, or business, or further studies in the social sciences and the humanities.

Graduates are prepared to start their professional careers as physicists. They are equipped for work in pure or applied science: their primary function is the solution of problems which have not yet been reduced to standard engineering practice.

ENGINEERING

THE CURRICULUM IN ENGINEERING PHYSICS

FIRST SEMESTER

FRESHMAN YEAR

SECOND SEMESTER

See page 100

FIRST SEMESTER

SOPHOMORE YEAR

SECOND SEMESTER

Course No.	Course Title	Cr. Hrs.	Course No.	Course Title	Cr. Hrs.
Chem. 91	Physical Chem.	3	Eco. 4	Economics	3
Eco. 3	Economics	3	†Ger.	German	3
†Ger.	German	3	or	Approved Elec.....	3
or	Approved Elec.....	3	Math. 14	Calculus III.....	3
Math. 13	Calculus II.....	3	Mech. 3	Statics & Dynamics.....	3
Phys. 24	Elec. & Magnetism.....	4	Phys. 23	Heat, Sound & Light. 4	
M.S.A.S. 3	Mil./Air Science	2	M.S.A.S. 4	Mil./Air Science	2
P.E. 3	Physical Education	—	P.E. 4	Physical Education	—
		18			18

FIRST SEMESTER

JUNIOR YEAR

SECOND SEMESTER

E.E. 104	A.C. Circuits.....	3	Mech. 302	Adv. Dynamics.....	3
E.E. 105	and A.C. Lab.....	1	Phys. 111	Elect. Lab.....	1
or		or	Phys. 191	Lab. Techniques	1
E.E. 160	El. Cir. & App.....	3	Phys. 213	Theo. Elec. & Mag.....	3
E.E. 161	and El. Probs.....	1	Phys. 252	Optics	4
E.E. 162	and Dyn. Lab.....	1		*General Study.....	3
Math. 206	Adv. Calculus	3		Elective	3
Phys. 110	Elect. Lab.....	1			
Phys. 212	Theo. Elec. & Mag.....	3			
Phys. 340	Heat & Thermo.....	4			
	*General Study.....	3			
		18 or 19			18

SUMMER

Phys. 100, Industrial Employment

FIRST SEMESTER

SENIOR YEAR

SECOND SEMESTER

Phys. 314	Phys. of Electronics.....	4	Phys. 269	Modern Theories.....	3
Phys. 268	Modern Theories.....	3	Phys. 193	Advanced Lab.....	2
Phys. 192	Advanced Lab.....	2	Phys. 171	Proseminar	1
Phys. 362	Spectroscopy	3	Phys. 315	Electric Waves.....	4
or		or	Phys. 363	Mod. Th. Solids.....	3
Elective		or	or		or
*General Study.....		3	Elective,	if Phys. 362 has	4
Electives		3		been completed.....	3
				*General Study.....	3
				Electives	4-6
		18			17 or 18

*For an elucidation of this requirement see page 98.

†Students who have had no German in preparatory school will take Ger. 1 and 2, Elementary German. Those who offer two units of German for entrance will take Ger. 3, Intermediate German, and Ger. 7, Scientific German. Students whose previous training, formal or otherwise, in the language represents more than the equivalent of two years of preparatory school German will take, at the discretion of the curriculum director, three or six hours of work in other fields instead of German, the specific courses to be designated by the curriculum director.

THE COMBINED FIVE-YEAR CURRICULUM IN ELECTRICAL ENGINEERING AND ENGINEERING PHYSICS

This curriculum is designed to meet the needs of those who plan a career in electronics and communications research and development. It differs from the standard four-year Communications Option in Electrical Engineering in that certain courses of primary interest to power engineers have been replaced by subjects in physics and mathematics. It differs from the four-year curriculum in Engineering Physics with a communications minor in that the fundamental electrical engineering courses in fields, transients, and machines have been added. The similarity of the basic requirements of the two curricula permits the inclusion of the necessary advanced work in mathematics and dynamics.

For men planning careers in the electronics communications area, it is believed that the greater breadth of training afforded by this combined program is preferable to early specialization in either field alone. It should be particularly noted that this program lays a solid foundation for graduate study in either physics or electrical engineering.

It is expected that students undertaking this combined program will make every effort to complete the five years. The B.S. (E.E) degree is conferred on the successful completion of the fourth year, and the B.S. (E.P.) degree at the end of the fifth year.

THE COMBINED FIVE-YEAR CURRICULUM IN ELECTRICAL ENGINEERING AND ENGINEERING PHYSICS

SECOND SEMESTER

FIRST SEMESTER			SOPHOMORE YEAR		SECOND SEMESTER		
<i>Course No.</i>	<i>Course Title</i>	<i>Cr. Hrs.</i>	<i>Course No.</i>	<i>Course Title</i>	<i>Cr. Hrs.</i>		
Math. 13	Calculus II.....	3	Math. 14	Calculus III.....	3		
Phys. 24	Elec. & Magnetism.....	4	Phys. 23	Heat, Light & Sound.....	4		
Mech. 1	Statics	3	Mech. 2	Dynamics	3		
Chem. 91	Physical Chemistry	3	E.E. 2	D.C. Machines	3		
Eco. 3	Economics	3	E.E. 3	D.C. Laboratory	1		
M.S.A.S. 3	Mil./Air Science	2	Eco. 4	Economics	3		
P.E. 3	Physical Education	—	M.S.A.S. 4	Mil./Air Science	2		
			P.E. 4	Physical Education	—		
		18			19		

SECOND SEMESTER

E.E.	104	A.C. Circuits	3	E.E.	106	A.C. Machines.....	3
E.E.	105	A.C. Laboratory	1	E.E.	107	A.C. Laboratory	1
Math.	206	Adv. Calculus	3	E.E.	110	Industrial Electronics.....	3
Mech.	111	Mech. Materials.....	3	Mech.	302	Adv. Dynamics.....	3
Mech.	113	Mat. Test. Laboratory..	1	Phys.	111	Elec. Laboratory.....	1
Phys.	110	Elec. Laboratory	1	Phys.	252	Geometrical and	
Phys.	340	Heat, Thermodynamics				Physical Optics.....	4
		and Pyrometry.....	4			*General Study	3
		*General Study	3				
			<hr/>				<hr/>
			19				18

FIRST SEMESTER		SENIOR YEAR		SECOND SEMESTER	
E.E.	332 Elec. Transients.....	3	E.E.	331 Elec. & Mag. Fields...	3
E.E.	141 Radio Communication..	3	E.E.	142 Radio Communication..	3
E.E.	143 Wire Communication..	3	E.E.	144 Wire Communication..	3
E.E.	108 A.C. Machines.....	3	E.E.	345 Electromagnetic Theory	3
E.E.	109 A.C. Machines Lab....	2	Math.	315 Func. of a Comp. Var.	3
	*General Study	3		*General Study	3
			E.E.	111 Proseminar	1
		18			19

SECOND SEMESTER

Math.	301	Vector & Tensor Ana.	3	Math.	322	Diff. Eq. & Harm. Ana.	3
Math.	324	Theory of Errors.....	3			Approved Elective.....	3
Phys.	314	Phys. of Electronics.....	4	Phys.	363	Modern Th. of Solids.....	3
Phys.	268	Modern Theories.....	3	Phys.	269	Modern Theories.....	3
Phys.	192	Adv. Laboratory.....	2	Phys.	193	Adv. Laboratory.....	2
Ger.	1	German of.....	2	Ger.	2	German of.....	2
		Approved Elective }.....	3			Approved Elective }.....	3
				Phys.	171	Proseminar.....	1
			18				1

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THE CURRICULUM IN GENERAL SCIENCE AND MATHEMATICS

The curriculum in general science and mathematics is designed to qualify men for teaching careers in biology, chemistry, physics and mathematics in secondary schools. In recognition of the increasing need for teachers whose teaching backgrounds are broad rather than highly specialized, the program is intentionally comprehensive. At the same time, sufficient study is required in the four major subjects to ensure adequate preparation in each.

Work in the major teaching subjects is continuous through all four years. During the freshman year the curriculum is identical with that required of all engineering students. The sophomore year includes those liberal arts courses common to other engineering curricula plus courses introductory to teaching. The junior year provides for the study of educational fundamentals and for practical experience in nearby public high schools. Nine hours of approved electives and a three-hour general-study elective are scheduled for the junior and senior years. One or more periods of summer employment in work with adolescents is required.

Graduates in this curriculum will be qualified for teaching certificates in the public high schools of Pennsylvania, New Jersey and other states. They will be prepared to enter graduate study in education with a view to certification for supervisory and administrative positions in the public schools. Should a student take all nine hours of approved electives in one of his four major teaching fields, he will, in most cases, need little additional preparation to qualify for graduate study in that field.

THE CURRICULUM IN GENERAL SCIENCE AND MATHEMATICS

FIRST SEMESTER

FRESHMAN YEAR

SECOND SEMESTER

See page 100

FIRST SEMESTER			SOPHOMORE YEAR			SECOND SEMESTER		
Course No.		Course Title	Cr. Hrs.	Course No.		Course Title	Cr. Hrs.	
Phys. 23		Heat, Sound & Light.....	4	Phys. 24		Elec. & Magnetism.....	4	
Math. 13		Calculus II.....	3	Math. 14		Calculus III.....	3	
Chem. 35		Analytical Chem.....	4	Psych. 1		Elem. Psychology	3	
Eco. 3		Economics	3	Eco. 4		Economics	3	
Hist. 13		U. S. History.....	3	Educ. 1		Intro. to Education	3	
M.S. A.S. 3		Mil./Air Science.....	2	M.S. A.S. 4		Mil./Air Science.....	2	
P.E. 3		Physical Education	—	P.E. 4		Physical Education	—	
			19				18	

THE CURRICULUM IN INDUSTRIAL ENGINEERING

There is a growing tendency on the part of industries to select young men from their engineering departments for managerial positions. Because of this, the Industrial Engineering curriculum, although basically and primarily engineering, is adequately supplemented by courses in business administration, production management, and psychology to enable the Industrial Engineering graduate to accept and succeed in these opportunities.

The curriculum is designed with the principal aim of Industrial Engineering in view, which is the improvement of the general standard of living as the result of increased worker productivity by the application of the principles of scientific management and the utilization of technical improvements when economically justifiable.

Throughout the program there is an integrated series or sequence in the major field which includes not only basic and fundamental courses, but specialized courses as well, in the fields of production planning and control, quality control, product engineering, work simplification, wage and salary administration and industrial relations.

It is the aim of the Industrial Engineering program to develop for industry a potential manager, a graduate well grounded in engineering fundamentals, trained in the principles of economics, accounting and psychology, and adequately prepared to practice the profession of Industrial Engineering.

THE FIVE YEAR COMBINED CURRICULUM INDUSTRIAL ENGINEERING AND BUSINESS ADMINISTRATION

Students with definite objectives in mind which require more concentration in business administration may elect to pursue a five-year program which combines the two curricula of industrial engineering and business administration. This combined curriculum will lead to the degree B.S. in Industrial Engineering at the end of the fourth year and B.S. in Business Administration at the end of the fifth year. The first four years are essentially the standard industrial engineering curriculum. For the fifth year please see page 92 under Business Administration.

ENGINEERING

THE CURRICULUM IN INDUSTRIAL ENGINEERING

FIRST SEMESTER

FRESHMAN YEAR

SECOND SEMESTER

See page 100

SUMMER

M.E. 1, Machine Shop Practice (3)

FIRST SEMESTER			SOPHOMORE YEAR		SECOND SEMESTER		
Course No.	Course Title	Cr. Hrs.	Course No.	Course Title	Cr. Hrs.	Course No.	Course Title
Eco. 3	Economics	3	Eco. 4	Economics	3	Eco. 3	Economics
Mech. 1	Statics	3	Mech. 2	Dynamics	3	Mech. 1	Dynamics
Math. 13	Calculus II.....	3	Math. 14	Calculus III.....	3	Math. 13	Calculus III.....
Met. 63	Engr. Mat. & Proc.....	3	M.E. 2	Elem. Machine Des.....	3	M.E. 2	Elem. Machine Des.....
M.S.A.S. 3	Mil./Air Science.....	2	M.S.A.S. 4	Mil./Air Science.....	2	M.S.A.S. 3	Mil./Air Science.....
Phys. 23	Heat, Sound & Light.....	4	Phys. 24	Elec. & Magnetism.....	4	Phys. 23	Elec. & Magnetism.....
P.E. 3	Physical Education	—	P.E. 4	Physical Education	—	P.E. 3	Physical Education
18			18		18		

FIRST SEMESTER			JUNIOR YEAR		SECOND SEMESTER		
E.E. 160	Elec. Circ. & App.....	3	I.E. 115	Personnel Admin.....	3	I.E. 115	Personnel Admin.....
E.E. 161	Elec. Problems.....	1	I.E. 116	Plant Admin.....	3	I.E. 116	Plant Admin.....
E.E. 162	Dynamo Lab.....	1	M.E. 102	Machine Design	3	M.E. 102	Machine Design
I.E. 110	Engrg. Economy	3	Mech. 121	Mech. of Fluids.....	3	Mech. 121	Mech. of Fluids.....
I.E. 114	Plant Admin.....	3	Mech. 123	Hydraulics Lab.....	1	Mech. 123	Hydraulics Lab.....
Mech. 111	Mech. of Materials	3	Math. 233	Math. Statistics.....	3	Math. 233	Math. Statistics.....
Mech. 113	Materials Test. Lab.....	1	Psych. 1	Elem. Psychology	3	Psych. 1	Elem. Psychology
	*General Study Option 3						
18			18		19		

SUMMER

I.E. 100, Industrial Employment

FIRST SEMESTER			SENIOR YEAR		SECOND SEMESTER		
Acctg. 104	Acctg. for Engrs.....	3	Acctg. 106	Cost Acctg. for Engrs. 3			
M.E. 160	Heat Power	3	I.E. 350	Ind. Eng. Problems... 1			
	Business Elective.....	3	M.E. 161	Engineering Lab.....	1		
†I.E.	6	†I.E.	Business Elective.....	3		
	*General Study Option 3			6		
18			18		17		

*For an elucidation of this requirement see page 98.

†I.E. 325	Production Control.....	3	I.E. 328	Work Simplification	3
I.E. 326	Quality Control.....	3	I.E. 329	Wage & Salary Admin. 3	
I.E. 327	Product Engineering....	3	I.E. 330	Industrial Relations	3

THE FIVE YEAR COMBINED CURRICULUM INDUSTRIAL ENGINEERING AND BUSINESS ADMINISTRATION

FIRST SEMESTER			JUNIOR YEAR		SECOND SEMESTER		
E.E. 160	Elec. Circ. & App.....	3	I.E. 115	Personnel Admin.....	3	I.E. 115	Personnel Admin.....
E.E. 161	Elec. Problems.....	1	I.E. 116	Plant Admin.....	3	I.E. 116	Plant Admin.....
E.E. 162	Dynamo Lab.....	1	M.E. 102	Machine Design	3	M.E. 102	Machine Design
I.E. 110	Engr. Economy	3	Mech. 121	Mech. of Fluids.....	3	Mech. 121	Mech. of Fluids.....
I.E. 114	Plant Admin.....	3	Mech. 123	Hydraulics Lab.....	1	Mech. 123	Hydraulics Lab.....
Mech. 111	Mech. of Materials	3	E.S. 346	Bus. Cycles & Fore....	3	E.S. 346	Bus. Cycles & Fore....
Mech. 113	Materials Test. Lab.....	1	Psych. 1	Elementary Psych.....	3	Psych. 1	Elementary Psych.....
E.S. 145	Statistical Methods	3					
18			18		19		

NOTE: Those students who will major in Accounting in the fifth year will take Acctg. 104 and Acctg. 106 in the junior year in place of E.S. 145 and E.S. 146; and, in the senior year, E.S. 145 and E.S. 146 will be taken in place of Eco. 333 and Eco. 111; and Acctg. 13 and Acctg. 14 will be taken in place of Acctg. 104 and Acctg. 106; Eco. 333 and Eco. 111 will be taken in the fifth year.

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FIRST SEMESTER		SENIOR YEAR		SECOND SEMESTER			
Acctg.	104	Acctg. for Engrs.	3	Acctg.	106	Cost Acctg. for Engrs.	3
M.E.	160	Heat Power	3	Fin.	125	Corp. Finance	3
Eco.	333	Labor Problems.....	3	M.E.	161	Engineering Lab.....	1
G.S.O.		English Elective.....	3	I.E.	350	Ind. Engrg. Prob.....	1
*I.E.			6	Eco.	111	Marketing	3
				G.S.O.		English Elective.....	3
				*I.E.			3
			18				17
*I.E.	325	Production Control.....	3	I.E.	328	Work Simplification.....	3
I.E.	326	Quality Control.....	3	I.E.	329	Wage & Salary Admin ..	3
I.E.	327	Product Engineering.....	3	I.E.	350	Industrial Relations	3

THE CURRICULUM IN MECHANICAL ENGINEERING

Mechanical engineering deals with the design, construction, installation, and operation of machinery necessary for the economical and advantageous use of power, and with the management of industries and organizations manufacturing and using power-driven equipment. The high degree of technical skill and efficiency essential to the work of research, design, construction, and operation, which underlies mechanical engineering practice, necessarily prescribes a training based on the fundamental sciences of chemistry, physics, and mathematics.

Aptitude and skill in the interpretation and application of the basic technical sciences are, however, not sufficient. In addition the engineer must acquire an understanding of the influences of his profession on social institutions and traditions. To this end the curriculum requires the student to register for courses in the College of Arts and Science or the College of Business Administration, or both, during each of the four years.

The curriculum is broad and designed to meet the needs of young men interested in the scientific and technical aspects of industry. During the first three years emphasis is placed on the fundamental principles underlying the numerous fields of mechanical engineering. In the senior year opportunity is provided for concentration in one of three broad fields; Power, Design, or Basic Sciences underlying Mechanical Engineering. The young graduate ordinarily enters a graduate apprenticeship in a public utility, manufacturing, or operating organization where opportunity is provided for his development in research, design, construction and operation, depending upon his interests and aptitudes and the opportunities available.

THE CURRICULUM IN MECHANICAL ENGINEERING

FIRST SEMESTER

FRESHMAN YEAR

SECOND SEMESTER

See page 100

SUMMER

M.E. 1, Machine Shop Practice (3)

FIRST SEMESTER			SOPHOMORE YEAR		SECOND SEMESTER		
Course No.		Course Title	Cr. Hrs.	Course No.		Course Title	Cr. Hrs.
Eco.	3	Economics	3	Eco.	4	Economics	3
Math.	13	Calculus II.....	3	Met.	61	Engrg. Metallurgy.....	2
M.E.	2	Elem. Mach. Des.....	3	Met.	68	Met. Problems.....	1
Mech.	1	Statics	3	Math.	14	Calculus III.....	3
Phys.	23	Heat, Sound & Light..	4	Mech.	2	Dynamics	3
M.S.A.S.	3	Mil./Air Science.....	2	Phys.	24	Elec. & Magnetism.....	4
P.E.	3	Physical Education	—	M.S.A.S.	4	Mil./Air Science.....	2
				P.E.	4	Physical Education	—
			18				18

FIRST SEMESTER			JUNIOR YEAR		SECOND SEMESTER			
Math.	206	Applied Mathematics I	3	M.E.	102	Machine Design	3	
M.E.	104	Thermodynamics	3	M.E.	105	Thermodynamics	3	
M.E.	106	Instruments Lab	1	M.E.	107	Mech. Engrg. Lab	1	
Mech.	121	Mech. of Fluids	3	E.E.	160	Elec. Cir. & App.	3	
Mech.	123	Hydraulics Lab	1	E.E.	161	Elec. Problems	1	
Mech.	111	Mech. of Materials	3	E.E.	162	Dynamo Lab	1	
Mech.	113	Materials Test. Lab	1			Approved Elective	3	
		*General Study	3			*General Study	3	
			18					18

SUMMER

I.E. 100, Industrial Employment

FIRST SEMESTER			SENIOR YEAR		SECOND SEMESTER		
M.E.	108	Mech. Engrg. Lab.....	2			App. Bus. Elective.....	3
M.E.	103	Adv. Mach. Design.....	3	M.E.	109	Mech. Engrg. Lab.....	2
†M.E.		Adv. Mech. Engrg.....	3	†M.E.		Adv. Mech. Engrg.....	3
Met.	65	Metallurgical Lab.....	1	Met.	66	Metallurgical Lab.....	1
		†Technical Option	6			†Technical Option	6
		*General Study	3			*General Study	3
			18				18

I HEAT POWER OPTION

FIRST SEMESTER			SECOND SEMESTER				
2 of these			2 of these				
M.E.	321	Heat Transfer.....	3	M.E.	333	Power Plants	3
M.E.	322	Mech. of Comp. Fl.....	3	M.E.	343	Instr. & Auto. Control	3
M.E.	330	Air Cond. & Refrig.....	3	M.E.	334	Int. Comb. Engrg.	3
M.E.	320	App. Thermo.....	3	M.E.	110	Thesis	3
			6				6

(Continued on following page)

*For an elucidation of this requirement see page 98.

†Advanced M.E. courses to be chosen, with the approval of the curriculum director, on the basis of the individual's interests.

‡These Technical Option courses are to be selected from one of the three options on this page and page 122.

LEHIGH UNIVERSITY

II DESIGN OPTION

2 of these				2 of these			
M.E.	341	Stress Anal. for Design	3	M.E.	340	Adv. Mach. Des.....	3
Math.	301	Vector Anal.	3	M.E.	342	Vibration Anal.....	3
Math.	221	Diff. Equations	3	Math.	322	Diff. Equations	3
M.E.	322	Mech. of Comp. Fl.....	3	C.E.	106	Structural Design	3
			6				6

III GENERAL OPTION

2 of these			2 of these				
Math.	315	Function of Complex Var.	3	Math.	324	Theory of Errors	3
Mech.	325	Aerodynamics	3	Mech.	326	Aerodynamics	3
Phys.	268	Modern Phys. Theory	3	Phys.	269	Modern Phys. Theory	3
Any courses from Options I or II				Any courses from Option I or II			
			6				6

THE COMBINED FIVE-YEAR CURRICULUM IN MECHANICAL-ELECTRICAL ENGINEERING

This curriculum is designed to meet the needs of the power engineer engaged in the operation of large public utilities for the generation and distribution of electrical energy, as well as for those concerned with the design of electrical machines and apparatus. It is generally recognized that the engineering work of the electrical manufacturers and public utilities in the power field encounters as many mechanical as electrical problems. These two types of problems are equally important and equally interesting. In order to carry out the design of electrical machinery and power plants it is now generally necessary to employ both mechanical and electrical engineers on the same job because, with rare exceptions, one engineer is not proficient in both fields.

This combined 5-year curriculum in M.E. and E.E. is intended to circumvent this deficiency in the present training of power engineers by offering a highly integrated, comprehensive, and balanced program which is devised to turn out graduates equally proficient in mechanical and electrical engineering and who in addition will have some grounding in those business courses which are deemed essential to the engineer when he eventually takes on executive and administrative responsibilities.

It is the intent of this curriculum that anyone undertaking it will make every effort to complete the five years. The B.S. (M.E.) degree will be conferred at the end of the fourth year, and the B.S. (E.E.), at the end of the fifth year.

ENGINEERING

THE COMBINED FIVE-YEAR CURRICULUM IN MECHANICAL-ELECTRICAL ENGINEERING

FIRST SEMESTER

FRESHMAN YEAR

SECOND SEMESTER

See page 100

SUMMER

M.E. 1, Machine Shop Practice (3)

FIRST SEMESTER			SOPHOMORE YEAR			SECOND SEMESTER		
<i>Course No.</i>	<i>Course Title</i>	<i>Cr. Hrs.</i>	<i>Course No.</i>	<i>Course Title</i>	<i>Cr. Hrs.</i>	<i>Course No.</i>	<i>Course Title</i>	<i>Cr. Hrs.</i>
Math. 13	Calculus II.....	3	Math. 14	Calculus III.....	3	Math. 14	Calculus III.....	3
Phys. 24	Elec. & Magnetism.....	4	Phys. 23	Heat, Light & Sound..	4	Phys. 23	Heat, Light & Sound..	4
Mech. 1	Statics	3	Mech. 2	Dynamics	3	Mech. 2	Dynamics	3
Met. 61	Engrg. Metallurgy.....	2	E.E. 2	D.C. Machines	3	E.E. 2	D.C. Machines	3
Met. 68	Met. Engrg. Probs.....	1	E.E. 3	D.C. Lab.....	1	E.E. 3	D.C. Lab.....	1
Eco. 3	Economics	3	Eco. 4	Economics	3	Eco. 4	Economics	3
M.S.A.S. 3	Mil./Air Science.....	2	M.S.A.S. 4	Mil./Air Science.....	2	M.S.A.S. 4	Mil./Air Science.....	2
P.E. 3	Physical Education.....	—	P.E. 4	Physical Education.....	—	P.E. 4	Physical Education.....	—

THE CURRICULUM IN METALLURGICAL ENGINEERING

The growing importance of metals for industrial and everyday use and for national defense has increased the need for men trained in the metallurgical branch of engineering. Metallurgy includes the production of metals from ores; purifying or refining them; working and fabricating them by such processes as casting; rolling, forging, welding, etc.; development of new alloys; and enhancing the properties of metals through alloying, heat treatment, and other means.

Training for this field of engineering includes the basic studies in mathematics, chemistry, and physics required in all sound engineering education. In addition to fundamental science, it includes certain basic courses from other fields of engineering, required because of their usefulness to the metallurgical engineer as well as to give him a broad engineering background. It provides the essential courses in metallurgy to facilitate entrance of the graduate into the metallurgical industry and his initial progress therein. Finally, it gives the student an introduction to humanistic and social studies which will broaden his outlook and lead to furthering his professional development after graduation.

The curriculum is designed to fulfill the essential requirements of the industry in a four-year course, to give the necessary foundation for those who can pursue graduate work, and to constitute the basis for well-rounded engineering education at the professional level. The "general studies" provide for selected non-technical courses from the College of Arts and Science or the College of Business Administration; the "electives" permit further study in the non-technical field, or additional work in science or foreign language in preparation for research, or additional engineering or business courses in accordance with the special interests or needs of the individual. The latter may include optional preparation in the field of electrometallurgy. The general studies and elective courses are chosen by the student subject to the approval of the curriculum director.

Metallurgical Practice Option

A Metallurgical Practice Option is offered by the Department of Metallurgical Engineering in cooperation with the Bethlehem Steel Co. In this option, a special course, Met. 325, Metallurgical Practice (9) is taken in the second semester of the senior year in place of an equivalent number of other specified courses. In Met. 325

three days per week are spent in the Bethlehem Plant, during which investigations of a development and plant test nature are carried out. The option is limited to a small group of seniors selected by the department from those who apply.

THE CURRICULUM IN METALLURGICAL ENGINEERING

FIRST SEMESTER			FRESHMAN YEAR		SECOND SEMESTER		
						See page 100	
FIRST SEMESTER			SOPHOMORE YEAR		SECOND SEMESTER		
Course No.	Course Title	Cr. Hrs.	Course No.	Course Title	Cr. Hrs.	Course Title	Cr. Hrs.
Chem. 38	Analytical Chem. 3	3	Eco. 4	Economics	3	Economics	3
Geol. 1	Prin. of Geology 3		Math. 14	Calculus III	3	Calculus III	3
Eco. 3	Economics	3	Mech. 2	Dynamics	3	Dynamics	3
Math. 13	Calculus II	3	Met. 1	Intro. to Met.	3	Intro. to Met.	3
Mech. 1	Statics	3	Phys. 23	Heat, Sound & Light..	4	Heat, Sound & Light..	4
Phys. 24	Elec. & Magnetism	4	M.S.A.S. 4	Mil./Air Science	2	Mil./Air Science	2
M.S.A.S. 3	Mil./Air Science	2	P.E. 4	Physical Education	—	Physical Education	—
P.E. 3	Physical Education	—					
			18		18		
FIRST SEMESTER			JUNIOR YEAR		SECOND SEMESTER		
Chem. 91	Physical Chemistry	3	Chem. 190	Physical Chemistry	3	Physical Chemistry	3
Met. 102	*General Study	3	Mech. 111	Mech. of Materials	3	Mech. of Materials	3
Met. 105	Met. of Iron & Steel..	3	Mech. 113	Mat. Testing Lab.	1	Mat. Testing Lab.	1
	Electrochemistry and		Met. 112	Iron & Steel Prob.	1	Iron & Steel Prob.	1
	Electrometallurgy	3	Met. 231	Metallurgy	3	Metallurgy	3
Met. 230	Physical Metallurgy ...	3		Engrg. Elective	3	Engrg. Elective	3
	Elective	3		*General Study	3	*General Study	3
			18		17		
SUMMER							
Met. 100, Summer Employment							
FIRST SEMESTER			SENIOR YEAR		SECOND SEMESTER		
M.E. 166	Proced. of Mech. Design	3	E.E. 160	Elec. Cir. & Appar.	3	Elec. Cir. & Appar.	3
Met. 103	Non-ferrous Met.	3	E.E. 161	Elec. Problems	1	Elec. Problems	1
Met. 338	Met. Colloquium	2	E.E. 162	Dynamo Lab.	1	Dynamo Lab.	1
Met. 352	Ad. Met. of Iron & Steel	3	Met. 104	Non-ferrous Met. 2	3	Non-ferrous Met. 2	3
Met. 363	Non-ferrous Met. Prob.	1	Met. 364	Prob.		Prob.	
	Professional Devel.	1		or		or	
P.D. 101	Professional Devel.	1	Met. 358	Industrial Met.	2	Industrial Met.	2
	Elective	3	Met. 375	Elec. Proj. in Met.	2	Elec. Proj. in Met.	2
	*General Study	3	P.D. 102	Professional Devel.	1	Professional Devel.	1
			19		16		
METALLURGICAL PRACTICE OPTION							
E.E. 160	Elec. Cir. & Appar.	3	Met. 325	Met. Practice	9	Met. Practice	9
E.E. 161	Elec. Problems	1	Met. 338	Met. Colloquium	2	Met. Colloquium	2
E.E. 162	Dynamo Lab.	1	Met. 358	Industrial Met.	2	Industrial Met.	2
M.E. 166	Proced. of Mech. Des. 3			*General Study	3	*General Study	3
Met. 103	Non-ferrous Met.	3	P.D. 102	Professional Devel.	1	Professional Devel.	1
Met. 352	Adv. Met. of Iron & Steel 3						
Met. 363	Non-ferrous Met. Prob. 1						
	*General Study	3					
P.D. 101	Professional Devel.	1					
			19		17		

*For an elucidation of this requirement see page 98.

THE CURRICULUM IN MINING ENGINEERING

Mining Engineering concerns itself with the exploration, development, extraction, and the initial preparation of the minerals and rocks that are needed to meet the demands of our modern civilization. So basic is the mining industry, so dependent on it are all individuals and industries, that ours has been called a "mineral civilization." Three great classes of materials are provided by the mining engineer: mineral fuels, including coal, petroleum, and natural gas; ores of the metals; non-metallics, such as slate, limestone, sand, and gravel.

The curriculum in Mining Engineering includes the basic sciences common to all branches of engineering—mathematics, physics, chemistry and mechanics. Three options are offered in the curriculum in mining engineering: (1) Mining Engineering, (2) Engineering Geophysics, (3) Mining Geology. A thorough and progressive training is provided in the specialized fields of the three options.

Mining Engineering Option

The option in Mining Engineering provides a training in the principles of mining and the methods used in extraction. Special attention is directed to the mechanization of mining operations; to mine ventilation, transportation, economics and administration; to mineral preparation. Technical courses in Civil, Electrical, and Mechanical Engineering form a part of this advanced work. All the operations at the mine are within the responsibility of the mining engineer. The actual work of extraction may be only one of his activities, for he may also have to deal with exploration, construction, transportation, preparation and processing, and all phases of mine administration. Modern mining has become, in many cases, a mass-production industry. The mechanization of mines has gone forward with startling rapidity. The need for engineering training was never more important.

Engineering Geophysics Option

The option in Engineering Geophysics has been developed to provide a more extensive training in prospecting and exploration. In this option, courses in geophysics, advanced mathematics, advanced physics, and in geology provide the training necessary for this advanced work. While many of the graduates in this option seek employment with the oil companies or geophysical contract-

ing companies, they are equally well prepared to pursue geophysics in Mining or Civil Engineering.

Mining Geology Option

The Mining Geology option permits those mining engineering students who wish to specialize in the exploration phase to substitute additional courses in Geology for some of the courses in engineering technology. Elective courses may be taken in the allied fields of arts or engineering. Students completing this option, and depending on their choice of electives, may expect to enter the employment of mining, oil, or contracting companies.

THE CURRICULUM IN MINING ENGINEERING

FIRST SEMESTER

FRESHMAN YEAR

SECOND SEMESTER

See page 100

SUMMER

C.E. 40, Land & Topographic Surveying (3)

FIRST SEMESTER		SOPHOMORE YEAR		SECOND SEMESTER	
Course No.	Course Title	Cr. Hrs.	Course No.	Course Title	Cr. Hrs.
Chem. 38	Analytical Chem.....	3	Eco. 4	Economics.....	3
Eco. 3	Economics.....	3	Math. 14	Calculus III.....	3
Math. 13	Calculus II.....	3	Mech. 2	Dynamics.....	3
Mech. 1	Statics.....	3	Min. 24	Mine Surveying.....	2
Phys. 23	Heat, Sound & Light..	4	Phys. 24	Elec. & Magnetism.....	4
M.S. A.S. 3	Mil./Air Science.....	2	M.S. A.S. 4	Mil./Air Science.....	2
P.E. 3	Physical Education.....	—	P.E. 4	Physical Education.....	—
		18			17

SUMMER

Min. 4, Mine Surveying, Field Work (2)

FIRST SEMESTER		JUNIOR YEAR		SECOND SEMESTER	
Mech. 111	Mech. of Materials	3	Acctg. 104	Acctg. for Engrs.....	3
Mech. 113	Mat. Testing Lab.....	1	Mech. 121	Mech. of Fluids.....	3
Geol. 1	Prin. of Geology.....	3	Mech. 123	Hydraulics Lab.....	1
Geol. 31	Mineralogy.....	3	Geol. 32	Petrology.....	3
Met. 61	Engr. Metallurgy.....	2	M.E. 160	Heat Power.....	3
Met. 68	Met. Problems.....	1	Min. 202	Methods of Mining.....	3
Min. 101	Min. Fundamentals	3	Engl. 142	Technical Writing.....	3
		19			19

SUMMER

Min. 100, Summer Employment

FIRST SEMESTER		SENIOR YEAR		SECOND SEMESTER	
E.E. 160	Elec. Cir. & Appar.....	3	C.E. 106	Structural Design.....	3
E.E. 161	Elec. Problems.....	1			3
E.E. 162	Dynamo Lab.....	1	Min. 204	Haul., Hoist., Pump.....	3
Min. 203	Mine Ventilation.....	3	Min. 206	Mine Administration ..	2
Min. 205	Mining Economics.....	3			6
Min. 207	Mineral Preparation....	3			6
		17			17

*For an elucidation of this requirement see page 98.

LEHIGH UNIVERSITY

ENGINEERING GEOPHYSICS OPTION

(The freshman and sophomore years are the same as the regular curriculum in mining engineering.)

FIRST SEMESTER		JUNIOR YEAR		SECOND SEMESTER	
Eng. Geop.	201	Geophysical Methods..	3	Eng. Geop.	202
Geol.	1	Prin. of Geology.....	3	Geol.	12
Geol.	31	Mineralogy	3	Geol.	32
Math.	206	Adv. Calculus	3	Mech.	111
Min.	101	Min. Fundamentals ...	3	Mech.	113
Phys.	212	Theo. Elec. & Mag....	3	Min.	202
				Phys.	213
			18		19

SUMMER

Min. 100, Summer Employment

FIRST SEMESTER		SENIOR YEAR		SECOND SEMESTER	
Eng. Geop.	301	Seismic & Mag. Pr....	3	Eng. Geop.	302
Mech.	121	Mech. of Fluids	3		
Min.	205	Mining Economics	3		
Phys.	314	Physics of Electronics	4	Geol.	312
		*General Study.....	6	Geol.	223
				Min.	206
				Engl.	42
			19		
					17

MINING GEOLOGY OPTION

SUMMER

C.E. 40, Land & Topographic Surveying (5)

FIRST SEMESTER		SOPHOMORE YEAR		SECOND SEMESTER	
Course No.	Course Title	Cr. Hrs.	Course No.	Course Title	Cr. Hrs.
Eco.	3	Economics	3	Eco.	4
Geol.	1	Prin. of Geology.....	3	Geol.	12
Math.	13	Calculus II.....	3	Math.	14
Mech.	3	Statics & Dynamics....	3	Min.	2
Phys.	23	Heat, Sound & Light..	4	Phys.	24
M.S. A.S.	3	Mil./Air Science.....	2	M.S. A.S.	4
P.E.	3	Physical Education.....	—	P.E.	4
			18		17

SUMMER

Min. 4, Mine Surveying, Field Work (2)

FIRST SEMESTER		JUNIOR YEAR		SECOND SEMESTER	
Chem.	38	Analytical Chem.....	3	Geol.	32
Geol.	31	Mineralogy	3	Geol.	223
Geol.	311	Paleontology	3	Geol.	312
		*General Study.....	3		
Mech.	111	Mech. of Materials....	3	Mech.	121
Mech.	113	Mat. Testing Lab.....	1	Mech.	123
Min.	101	Min. Fundamentals ...	3	Min.	202
			19		19

*For an elucidation of this requirement see page 98.

ENGINEERING

SUMMER

**Min. 100, Summer Employment or Geology Summer Camp

FIRST SEMESTER		SENIOR YEAR		SECOND SEMESTER	
E.E.	160	Elec. Cir. & Appar.....	3		
E.E.	161	Elec. Problems.....	1	Geol.	256
E.E.	162	Dynamo Lab.....	1	Min.	206
Geol.	255	Mineral Resources.....	3		
Min.	205	Mining Economics.....	3		
		**Geology Elective.....	3		
		***Technical Elective	3		
		17		17	

***Technical elective to be chosen from the following:

Chem.	91	Physical Chemistry	3	Chem.	190	Physical Chemistry	3
C.E.	139	Soil Mechanics	3	Acctg.	104	Acctg. for Engineers....	3
E.G.	201	Geophysical Methods..	3	E.G.	202	Geophysical App.	3
Ger.	1	Elem. German.....	3	Ger.	2	Elem. German.....	3
Min.	207	Mineral Preparation....	3	Min.	254	Adv. Min. Preparation	3

*For an elucidation of this requirement see page 98.

**An advanced course in Geology to be elected each semester. In case a geological summer camp is not attended during the Junior summer then either Geology 141 or Geology 146, Field Geology - (3) must be elected for the Geological Elective.

The Graduate School

The Graduate School

Administrative Officers

Martin Dewey Whitaker, *President*

Earl Kenneth Smiley, *Vice-President*

Harvey Alexander Neville, *Dean*

Charles Augustus Seidle, *Director of Admissions*

James Harold Wagner, *Registrar*

James Decker Mack, *Librarian*

Executive Committee of the Graduate Faculty

Dean Neville, *Chairman*, President Whitaker, and Vice-President Smiley (*ex officio*), Professors Hartman, W. L. Jenkins, Diamond, Stout and Parker.

Graduate study was a part of the original plan of the University and was announced in its first Register in 1886. More definite organization of the work along lines that are now generally accepted dates from 1883. Since that time the degrees of Master of Arts and Master of Science have been offered without interruption. The degree of Doctor of Philosophy was also announced for a time and twice conferred. In the middle nineties this degree was withdrawn; and doctoral work was not again offered until 1936, when it was once more authorized by the trustees. In 1951 the Graduate Faculty voted to award the Master of Business Administration, beginning in 1952. In 1936 the Graduate School was organized with a Graduate Faculty which has full power to enact the necessary legislation governing the work of the School. In 1952 a program of studies leading to the degree of Master of Business Administration was first offered. The Faculty is composed of the administrative officers of the Graduate School, the Deans of the Colleges, and all professors, associate professors and assistant professors who offer work for graduate credit. The rules and regulations of the Faculty are administered by an Executive Committee composed of the President and Vice-President of the University, the Dean of the Graduate School, and five elected members of the Graduate Faculty.

The Graduate School, in certain areas, offers to students with adequate preparation and ability opportunity for advanced study of an intensive kind and for training in the methods of investigation and research, with a view to their development as scholars and independent investigators in the fields of their choice. The School also aims to serve the needs of teachers and prospective teachers in elementary and secondary schools by providing opportunities for advanced professional training, and by preparing them for administrative positions.

Major work leading to the master's degree may be taken in the following fields: applied mechanics, bacteriology, biology, business administration, chemical engineering, chemistry, civil engineering, education, electrical engineering, English, geology, history and government, industrial engineering, international relations, mathematics, mechanical engineering, metallurgical engineering, mining engineering, physics, and psychology. In the fields of accounting, economics, finance, Greek, Latin, German, French, philosophy, sociology and Spanish, major work is not offered; but students majoring in other fields may take collateral work in these fields from the list of courses acceptable for graduate credit ("200" courses).

Work leading to the doctor's degree is offered in the following fields: bacteriology, chemical engineering, chemistry, civil engineering, electrical engineering, English, geology, history, mathematics, mechanical engineering, metallurgical engineering, and physics.

Prospective students who are interested in taking graduate work in particular fields are advised to get in touch with the heads of the departments concerned before attempting to register. Such consultation will be to their benefit, in that they will get a definite understanding as to the adequacy of their preparation, as well as of the facilities the University has to offer for the work which they desire.

Admission to Graduate Standing

A student who has taken the bachelor's degree or a degree in technology at a recognized college, university, or technical institution is eligible for admission as a graduate student. Actual admission is subject to enrollment limitations in each department, and

is therefore competitive. Each candidate must file at the Office of Admissions, on a form provided for the purpose, a statement of his collegiate experience and of his graduate objectives, and an official transcript of his academic record. The submission of Graduate Record Examination scores by a student applying for admission is urged and sometimes required. (For information about this examination, write to the Educational Testing Service, P. O. Box 592, Princeton, New Jersey.) If a student is applying for admission to graduate work in the Department of Education, scores may be submitted for either the Graduate Record Examination or the National Teachers Examination.

Admission to graduate standing permits the student to take any course for which he has the necessary qualifications. It does not imply admission to candidacy for a degree. Admission to candidacy for an advanced degree is granted in accordance with the provisions set forth below under "Degrees." Upon the recommendation of the department head concerned, if Graduate Record Examination scores have not been submitted, they may be required before a student is admitted to actual candidacy for an advanced degree.

Women are admitted as graduate students on the same terms as men. Except during a summer session, however, they are not permitted to attend, either as registered students or as listeners, courses intended primarily for undergraduates.

A graduate student who is absent from the university for a semester or more must obtain the written approval of the head of his major department in order to be readmitted to graduate standing. If the student has not established a major, he must obtain the approval of the Dean of the Graduate School.

Students of Lehigh University who are within a few hours of meeting the requirements for the bachelor's degree may, if given permission by the Graduate Faculty, enroll for a limited amount of work for graduate credit.

Registration

Several days are set aside for graduate registration just prior to the beginning of the semester as indicated in the calendar. However, advance registration can be completed any time in January, June or September, as the case may be, by obtaining a registration

ticket in the office of the Registrar and arranging an interview with the student's adviser. Anyone who can register in advance is urged to do so. Normally students are expected to complete their registration before the close of the third day of instruction. Registration after the tenth day of instruction in a regular semester or the fifth day in a summer session is permitted only when the express consent of the Dean of the Graduate School has been obtained.

It should be noted that graduate work itself starts promptly at the beginning of the term, and it is frequently true that graduate courses can be given only if there is a certain minimum demand for them. Delay in enrolling for a given course may therefore cause the course to be withdrawn.

A graduate student in residence must register each semester. A graduate student who is a degree candidate in absentia must register for that semester in which he expects to complete the degree requirements.

Tuition and Fees

The tuition in the Graduate School is \$300.00 per semester or \$22.00 per semester hour, whichever amount is lower, less a discount of 20% for those professionally engaged in the field of education. The maximum full-time roster of graduate courses is 15 semester hours.

Where the major department requires a master's thesis, the student registers for the thesis and pays at the rate of the regular semester hour charge, the minimum fee being \$40.00 (less 20% for those professionally engaged in the field of education).

Graduate students in residence must register and pay a minimum tuition or dissertation fee of \$50.00 per semester.

For a doctoral dissertation prepared in absentia a reading fee of \$50.00 is charged to those graduate students who have not paid a dissertation fee of at least \$50.00 while in residence.

Part-time graduate students are given the option of paying or not paying an athletic fee of \$7.50 per semester and a student activities fee of \$3.00 per semester. If they pay these fees, they obtain the corresponding benefits.

Refunds

For University regulations concerning refunds, see page 51.

Members of the University Staff

Full-time members of the University staff may not take more than six semester hours of graduate work in any one semester; half-time members of the staff may not take more than ten semester hours. Students under contract to devote not more than one-third of their time to University employment may take a maximum of thirteen semester hours per semester.

Filing of Application for Degree

Candidates for degrees to be conferred in June file with the Registrar, on a form provided for the purpose, on or before May 15, a written notice of their candidacy; candidates for degrees to be conferred in October file a similar notice on or before September 10. Failure to file such notice by the dates mentioned bars the candidate from receiving the degree at the ensuing graduation exercises.

Chemistry Breakage

For University regulations on breakage, see page 50.

DEGREES

In addition to the general regulations set forth below, more detailed instruction for procedures may be obtained from the Office of the Graduate School.

Students desiring to qualify for graduate degrees in the minimum time should have pursued an undergraduate major in the subject equivalent to that offered at Lehigh. At the discretion of the head of the department, a limited number of credits in closely allied subjects may be accepted in lieu of courses in the undergraduate major. Those with undergraduate deficiencies who are admitted because otherwise well qualified will be expected to make up such deficiencies in addition to satisfying the minimum requirement for the degree sought.

Master of Arts, Master of Science, and Master of Business Administration

The master's degree is granted to properly qualified students who complete satisfactorily at least two full semesters of advanced work. In meeting the requirements for the degree, the student must comply with the following regulations:

1. Each candidate for the master's degree must submit for the approval of the Graduate Faculty the program of courses he proposes to take to satisfy the requirements. This program must have the approval of the head of the student's major department, and all courses included which are not offered by the student's major department must also be approved by the heads of the departments concerned. Approval of the program by the Graduate Faculty signifies that the student has formally been admitted to candidacy for the degree.

2. The *minimum* program for the master's degree must include:

- a. Not less than thirty semester hours of graduate work.
- b. Not less than twenty-four hours of "300" and "400" level course work of which at least eighteen hours shall be from the "400" group (see page 145 for classification of courses).
- c. Not less than eighteen hours in the major field.
- d. Not less than fifteen hours of "400" courses in the major field.

3. The eighteen hours required in the major field are ordinarily taken in one department. Specific exceptions to this rule are mentioned in the departmental statements at the head of course listings. The remaining twelve hours of a *minimum* program, or any part of them, may also be taken in the major department; or they may be taken in any other field in which courses for graduate credit are offered, as the needs or interests of the student may indicate, subject to the approval of the head of the major department. In all cases, the work for the master's degree must be taken under at least two instructors.

4. Graduate students registered in "200" and "300" courses may be assigned additional work at the discretion of the instructor.

5. A thesis may be required by the major department. If required, the thesis shall not count for more than six semester hours. The credit to be allowed shall be fixed by the head of the major department. Two bound typewritten copies of the thesis (one of which shall be an original copy), approved by the faculty members under whom the work was done and by the head of the major department, shall be placed in the hands of the Dean of the Graduate School at least two weeks before the day on which the degree

is to be conferred. Information as to the form in which the thesis must be presented may be obtained from the Office of the Graduate School.

6. The master's degree is not granted unless the candidate has earned the grades A or B in at least eighteen hours of the work on his program and in all "300" courses in his major field. No course in which the grade earned is less than C is credited toward the degree.

7. All work which is to be credited toward a master's degree must be done in actual and regular attendance at Lehigh University.

8. All work on a program for the master's degree must be completed within a six-year period.

When all requirements have been met, the candidate is recommended by the Faculty to the trustees for the master's degree appropriate to the work pursued.

Doctor of Philosophy

The degree of Doctor of Philosophy is conferred on candidates who have demonstrated general proficiency and high attainment in a special field of knowledge and capacity to carry on independent investigation in that field as evidenced by the presentation of an acceptable dissertation embodying the results of original research. The requirements for the degree are more specifically set forth in the following regulations:

1. **TIME REQUIREMENTS.** A candidate ordinarily is expected to devote three or more academic years to resident graduate study. In no case is the degree awarded to one who has spent less than two full academic years in resident graduate work. Study for any specified period of time, however, is not in itself regarded as sufficient ground for the award of the degree.

Graduate work done in residence at other institutions will be accepted in partial fulfillment of the time requirements, provided such work is approved by the Graduate Faculty and by the departments concerned.

Work of fragmentary character scattered over a long period of years, or work completed many years before the student becomes

a candidate for the degree is subject to special review by the Graduate Faculty. The extent to which such work may be credited towards the fulfillment of the time requirements will be decided by the Faculty. All work on a program for the Ph.D. degree must be completed within a ten-year period.

2. RESIDENCE REQUIREMENTS. A candidate for the degree must complete at least one full academic year of resident graduate study at Lehigh University.

3. ADMISSION TO CANDIDACY. Candidates for the doctorate are accepted in a limited number of departments only, and a department may limit the number of candidates accepted in any year. In exceptional cases new students may be admitted to candidacy immediately upon registration in the Graduate School. Ordinarily, however, they are required to spend at least one semester in residence before they are accepted as candidates. Admission to candidacy is at the discretion of the Graduate Faculty and is granted only upon written application by the student. The applicant must have the endorsement of the departments concerned. The proposed major department may require a qualifying examination. In passing upon a student's application, the Faculty will take into consideration the applicant's general education, as well as his special qualifications for work in his chosen field. Each applicant is notified by the Dean of the Graduate School, in writing, of the action of the Faculty upon his application.

The application of a foreign student must be accompanied by a statement from the department in which he intends to specialize, certifying that he has a satisfactory command of English.

At the time of admission to candidacy a special committee is appointed by the Executive Committee of the Graduate Faculty to direct the work of the candidate.

4. PLAN OF WORK. Preparation for the degree is based on the study of a major subject, to which one or two minors may be added. The program of work, to be formulated by the candidate, his special committee, and the head of his major department, should be planned to lead to a general mastery of the major field and to a significant grasp of any minor that may be added. The program must be approved by the Executive Committee of the Graduate Faculty.

While there is no definite requirement as to the number of courses to be taken, two years devoted to formal courses is the customary minimum. In no instance, however, is the degree awarded merely for the faithful completion of any program of courses.

5. LANGUAGE REQUIREMENTS. The candidate must give evidence, through examinations, of a reading knowledge, sufficient for the purposes of his special studies, of at least two foreign languages (in addition to any language which may constitute his major subject). In each case the required languages are designated by the candidate's major department and approved by the Graduate Faculty. The language requirements must be satisfied before the student presents himself for the general examination, described below.

Language examinations are in charge of a committee consisting of representatives of the language department concerned and of the candidate's major department.

Permission to take the language examinations does not imply admission to candidacy for the degree.

6. GENERAL EXAMINATION. The general examination for the doctorate is designed to test both the student's capacity and his proficiency in his field of study. The examination is not necessarily confined to the content of courses that have been taken at Lehigh University or elsewhere. It is held ordinarily not earlier than toward the close of the second year of work, nor later than seven months prior to the time when the candidate plans to receive the degree. The student's special committee is in charge of the examination, which may be both written and oral.

The Dean of the Graduate School should be notified in advance when the general examination has been scheduled by the candidate's department head. No student is permitted to take this examination who has not been admitted to candidacy for the doctorate or who has not satisfied the language requirements.

Should a candidate fail in the general examination, he may be permitted by the Graduate Faculty to present himself for a second examination not earlier than five months after the first. If the results of the second trial are also unsatisfactory, no further examination is set.

7. **DISSERTATION.** The candidate is required to present a dissertation prepared under the general direction of a professor at Lehigh University. The dissertation shall treat a topic related to the candidate's major subject, embody the results of original research, give evidence of high scholarship, and constitute a contribution to knowledge. It must be approved by the professor under whose direction it was written, by the candidate's special committee, and by the Graduate Faculty. A copy bearing the written approval of the professor in charge must be presented to the Dean of the Graduate School for transmission to the student's special committee not later than May 1, if the degree is to be conferred in June, not later than September 1, if the degree is to be conferred in October.

The candidate shall deposit with the Dean of the Graduate School, at least one week before the degree is to be conferred, (1) the original typescript of the accepted dissertation, unbound, in standard form, and suitable for microfilming; (2) the first carbon copy of the accepted dissertation in standard form and binding; (3) two copies of an abstract, not exceeding 600 words, of the dissertation; (4) a receipt from the Bursar for the payment of the publication fee of twenty-five dollars (\$25.00). The publication fee is used by the University to defray the cost of publishing the dissertation on microfilm (through University Microfilms) and the abstract in *Dissertation Abstracts*. If the Candidate wishes to copyright his dissertation, he may do so by paying the copyright fee of ten dollars (\$10.00) to the Bursar at the time the publication fee is paid. Arrangements for copyright in the author's name will then be made by the University through University Microfilms.

8. **FINAL EXAMINATION.** After the dissertation has been accepted by his special committee, the candidate will be examined orally by the officers of professional rank in the departments concerned and such other persons as may be selected by the candidate's special committee.

9. **CONFERRING OF DEGREE IN ABSENTIA.** The degree of Doctor of Philosophy will not be conferred in absentia unless the candidate is excused by the President of the University.

Professional Degrees

Professional engineering degrees such as Civil Engineer (C.E.), Mechanical Engineer (M.E.), etc., are awarded to graduates of Lehigh University having the degree of Bachelor of Science in Civil Engineering, Bachelor of Science in Mechanical Engineering, etc., who have had not less than five years of acceptable practical experience in responsible charge of work after graduation, and who submit a suitable thesis. A candidate who has received a master's degree from Lehigh University is eligible for the professional degree on the same basis. A year of acceptable graduate work at Lehigh or elsewhere may be counted as partial satisfaction of the requirement of five years of acceptable experience.

Persons interested in obtaining a professional degree should consult the head of the department concerned.

Postdoctoral Work

Students who have completed the requirements for the doctorate may enroll for postdoctoral individualized study under the guidance of selected members of the faculty. Such a program of study contemplates a broad educational and research development at advanced and mature levels, and provides opportunities to prepare for specific positions. A formal certification of such work as may be accomplished by the student will be made.

Miscellaneous Regulations

The normal roster of a full-time graduate student is fifteen semester hours. Larger rosters may be taken only on the specific approval of the Graduate Faculty, and such approval may be expected only under exceptional circumstances. Graduate students who are employed elsewhere and can give only part of their time to graduate work should restrict the size of their rosters accordingly.

Graduate students who hold University appointments of any kind are permitted to enroll for only a limited amount of graduate work. Full-time employees of the University may not take more than six semester hours of graduate work in any one semester; half-time employees may not take more than ten semester hours. Students under contract to devote not more than one-third of their time to University employment may take a maximum of thirteen semester hours per semester.

With the consent of the head of his major department and of the head of the department concerned, a graduate student may be admitted as a regular listener in one or more courses, which course or courses shall be outside his approved program of studies for the degree; provided that the total number of hours in which he is registered and in which he is a listener shall not exceed the limits above set forth for employees of the University. In no case shall a student who has attended a course as a listener be given an examination for credit in that course.

Evening Classes and Summer Session

For the benefit of graduate students who, by reason of employment in the fields of teaching or industry, cannot attend classes during the day, a certain number of courses are generally offered in the evening and on Saturday morning. It cannot be announced in advance which courses these will be; but a student who is interested may receive the necessary information by communicating, before the beginning of each semester, with the head of the department in the field in which he is interested. During the 1954-1955 academic year evening and Saturday classes are held in accounting, civil engineering, economics, education, English, government, history, industrial engineering, international relations, mechanical engineering, metallurgy and psychology. It is anticipated that in the future such courses will be offered in additional subjects as the demand warrants.

The University offers each summer a limited number of courses which may be taken for the usual graduate credit. The courses offered vary from year to year. Information as to the offerings for any particular year may be obtained by writing to the Director of the Summer Session for the Summer Session Announcement.

Description of Courses

Description of Courses

Following is a list of undergraduate and graduate courses offered by Lehigh University. For purposes of record, all approved courses are listed. It must be understood, however, that the offerings in any given semester are contingent upon a number of factors, including student needs as determined at the time of pre-registration.

Credit Hours

The number in parentheses following each course title indicates the credit value of the course in terms of semester hours. Three hours of drawing, of work in the laboratory, or of practice in the field are regarded as the equivalent of a recitation or lecture of one hour's duration.

Course Numbering

Courses are numbered according to the following system:

- 0-99 Undergraduate courses, primarily for underclassmen. Not available for graduate credit.
- 100-199 Advanced undergraduate courses. Not open to freshmen and sophomores except on petition. Not available for graduate credit.
- 200-299 Courses open to advanced undergraduates and graduates. Not available for graduate credit in the major field.
- 300-399 Courses open to advanced undergraduates and graduates. Available for graduate credit in the major field.
- 400-499 Courses open to graduate students only.

Prerequisites

Academic preparation required for admission to courses is indicated under "Prerequisites" following course descriptions, stated in most cases, for purposes of convenience, in terms of Lehigh courses. Status required for admission, where numbering does not fully describe this status, is also indicated under "Prerequisites."

A student who does not have the status or the academic preparation set forth as prerequisites must, in order to be admitted to a course, file with the Registrar, at the time of registration and on a standard form provided by the Registrar a waiver of prerequisites

signed by the instructor teaching or in charge of the course, the head of the teaching department, and the student's curriculum director. Academic work completed elsewhere must be attested in this manner as being substantially equivalent to prerequisites listed, unless the student's records in the Office of the Registrar show that the proper officers have so evaluated this preparation previously.

ACCOUNTING

Professors Cowin, Bratt, and Allen

Associate Professor Koch

Assistant Professors Kubelius and Moore

Messrs. O'Neill, Altenberger, Wert

ACCOUNTING

Acctg. 1. Accounting (3)

The elementary principles of accounting, with problem work to develop a knowledge of accounting method and practice. Financial statements and their preparation, analysis and recording of transactions, journalizing and posting, use of special ledgers and journals, adjusting and closing accounts. First and second semesters.

Acctg. 2. Accounting (3)

Elementary accounting problems peculiar to proprietorships, partnerships, and corporations; manufacturing enterprises; depreciation; and a more detailed consideration of financial statements than is possible in Acctg. 1. *Prerequisite: Acctg. 1.* First and second semesters.

Acctg. 13. Intermediate Accounting (3)

Problems of the balance sheet, its form and content. The nature of assets, liabilities, and capital stock. Criteria of income and the matching of income and expense. Consignments, installment sales and statement analysis. *Prerequisite: Acctg. 2.* First semester.

Acctg. 14. Intermediate Accounting (3)

A continuation of Acctg. 13. *Prerequisite: Acctg. 13.* Second semester.

Acctg. 104. Accounting for Engineers (3)

An intensive course in the principles and practices of accounting, covering the fundamentals in one semester. Especially designed for engineering students. First and second semesters.

Acctg. 106. Cost Accounting for Engineers (3)

A one semester course in cost finding and cost analysis, designed especially for engineering students. Cost elements, costing methods, and the use of cost data for purposes of cost control. *Prerequisite: Acctg. 2 or 104.* Second semester.

Acctg. 115. Cost Accounting (3)

The principles and methods used to determine unit costs of product or services. Material, labor, and overhead costs, methods of distributing overhead, and the application of cost principles to job order and process production. *Prerequisite: Acctg. 2 or 104.* First semester.

For Advanced Undergraduates and Graduates

Acctg. 203. Federal Tax Accounting (3)

The most recent revenue acts; procedures in using the law and regulations to determine the amount of the tax liability for individuals, partnerships, trusts, and corporations. *Prerequisite: Acctg. 2 or 104.* First semester.

Mr. Koch

Acctg. 218. Advanced Cost Accounting (3)

Special cost problems such as: standard costs, distribution costs, joint costs. The managerial use of cost data, control of costs, and design of cost accounting systems. *Prerequisites: Acctg. 115 or Acctg. 106.* Second semester.

Mr. Koch

Acctg. 219. Specialized Accounting Systems (3)

Charts of accounts and the adaptation of accounting principles to business enterprises in various industries. *Prerequisite: Acctg. 115 and 313.* Second semester.

Mr. Moore

Acctg. 315. Advanced Accounting (3)

Problems of partnerships, branches and agencies, consolidations and mergers. Accounting for estates, trusts, and insolvent concerns. Second semester. *Prerequisite: Acctg. 314.*

Mr. Koch

Acctg. 320. Auditing (3)

The different types of audits and special investigations. Problems involving audit principles and procedure; methods of detecting and preventing fraud; the writing of audit reports; the ethics and the legal responsibilities of accountants. *Prerequisite: Acctg. 314.* First semester.

Mr. Moore

Acctg. 371. Readings in Accounting (3)

An unrostered course designed for students having special interest in some phase of accounting not covered by the rostered courses. The study may be in the history of accounting, accounting theory, municipal or public utility accounts, or any special subject approved by the instructor. *Prerequisite: consent of the head of the department.* First and second semesters.

Messrs. Allen, Cowin, Koch, Moore

ECONOMIC STATISTICS

E.S. 145. Statistical Method (3)

The methods of statistical description and induction, including tabular and graphic analysis and presentation. *Prerequisite: Eco. 3.* First semester.
Mr. Bratt

For Advanced Undergraduates and Graduates

E.S. 346. Business Cycles and Forecasting (3)

The nature of the business cycle and the application of statistics to business trends, with special attention to forecasting and business barometers. *Prerequisite: E.S. 145 or approved equivalent.* Second semester.
Mr. Bratt

E.S. 347. National Income Analysis (3)

Analysis of income and product aggregates from the point of view of development and structural breakdown, emphasizing sector accounts, saving and investment. *Prerequisite: E.S. 346.* First semester.
Mr. Bratt

E.S. 348. Advanced Business Cycles (3)

Recent business cycle theories; the evolution of the theories, and the problems of economic change which the theories attempt to explain. *Prerequisite: E.S. 346.* Second semester.
Mr. Bratt

E.S. 352. Advanced Statistical Method (3)

Sampling and correlation methods employed in industry and government. *Prerequisite: E.S. 145 or approved equivalent.* Given in alternate years. First semester.
Mr. Bratt

E.S. 353. Time Series Analysis (3)

Statistical measurement of economic change. *Prerequisite E.S. 346.* Given in alternate years. First semester.
Mr. Bratt

E.S. 371. Readings in Economic Statistics (3)

An unrostered course designed for students with special interests in some field of economic change or economic forecasting. *Prerequisite: E.S. 346 and consent of the head of the department.* First semester.
Mr. Bratt

E.S. 372. Readings in Economic Statistics (3)

Continuation of E.S. 371, *Prerequisite: E.S. 346 and consent of the head of the department.* Second semester.
Mr. Bratt

For graduate program see Business Administration

LAW

Law 101. Business Law (3)

The law of contracts and bankruptcy, agency bailments and sales. First semester.

BIOLOGY

Law 102. Business Law (3)

The law of negotiable instruments, partnership, corporations, real property, insurance, and security devices. *Prerequisite: Law 101.* Second semester.

Law 204. Wills, Estates, and Trusts (3)

A study of the basic legal and management principles and practices involved in the planning and administration of wills, estates, and trusts. Second semester. *Prerequisite: Law 101.* Mr. Kubelius

ASTRONOMY

See Mathematics and Astronomy

ATHLETICS

See Division of Athletics and Physical Education

BIOLOGY

Professors S. J. Thomas, Trembley and Parker

Associate Professors Owen and Grainger

Mr. Ritter

No student may take for credit more than one of the following courses: Biol. 1. Biology (3); Biol. 13. Human Biology (3); Biol. 33 and 34. Biology and Organic Evolution (6).

Biol. 1. Biology (3)

General distribution requirement for arts students who do not intend to major in biology. A general course in biological types and principles. Two lectures and one laboratory period per week. First semester.

Biol. 3. Comparative Vertebrate Anatomy (3)

A course in vertebrate zoology with emphasis on the study of homologous body structures in the various vertebrate classes and their relationship to the functional demands of habit and environment in each class. Detailed dissections of representative vertebrates are made in the laboratory. One lecture and two laboratory periods each week. *Prerequisite: One semester of zoology with laboratory.* First semester.

Biol. 4. Vertebrate Embryology (3)

A study of reproduction from germ cell formation through establishment of the principal organ systems of the vertebrate body. Various mechanical and physiological problems confronting the growing embryo are considered, and direct observations of whole-mounts, sections and living material are made in the laboratory. Two lectures and one laboratory period each week. *Prerequisite: One semester of zoology with laboratory; Biol. 3.* Second semester.

Biol. 6. Botany (3)

Fundamentals of the morphology and physiology of plants. The evolutionary development of the plant kingdom. Two lectures and one laboratory period per week. Field trips in the spring. Second semester.

Biol. 13. Human Biology (3)

A lecture course in biological principles as illustrated by man. Man in relation to his environment, the organ systems of man, population biology, parasitism, elements of human inheritance and human evolution. First and second semesters.

Biol. 18. Genetics (2)

A study of the basic laws governing inheritance in plants and animals, chromosome behaviour, nature of genes. The relation of environmental modifications, hybrid variation, and mutations to the mechanics of evolution. First semester.

Biol. 31. Zoology (3)

A foundation course for majors in biology. Living things are studied from a functional rather than a purely morphological viewpoint. Proto-plasm, cellular metabolism, reproduction, and other fundamental conceptions of life-processes. Lectures and laboratory. First semester.

Biol. 32. Zoology (3)

A continuation of Biol. 31. *Prerequisites: Biology 31 or consent of instructor.* Second semester.

Biol. 33. Biology and Organic Evolution (3)

A lecture and recitation course in animal biology with special reference to man. A survey of the lower forms of life and their evolution; the biology of the individual and of populations; genetics and human evolution. First semester.

Biol. 34. Biology and Organic Evolution (3)

A continuation of Biol. 33. Second semester.

Biol. 36. Economic Botany (3)

Economic products of plant origin from the point of view of their development, structural characteristics, uses, and sources. Two recitations and one laboratory period per week. First semester.

Biol. 50. Sanitary Bacteriology (3)

Study of bacteria and allied microorganisms by staining and cultural methods; their sanitary importance in public water supplies; the bacteriology of sewage and sewage treatment; qualitative and quantitative bacteriological and biological analysis of water, milk, and sewage. Lectures, recitations, and laboratory. Second semester.

Biol. 52. Bacteriology (3)

Elementary general bacteriology. The morphological and cultural characteristics of bacteria and allied microorganisms; special attention to forms of sanitary and economic importance; the role of bacteria, yeasts, and molds in fermentation industries, in water and milk. Lectures, recitations, and laboratory. First semester.

Biol. 61. Bacteriology (3)

An elementary course for students specializing in biological sciences. Special staining methods in the study of morphology; differential media in bacterial physiology; thorough study of staining, cultural and biochemical properties of the microorganisms themselves rather than their specific sanitary or industrial importance. Recitations, lectures, and laboratory work. First semester.

Biol. 62. Bacteriology (3)

Continuation of Biol. 61. *Prerequisites: Biol. 61 or consent of instructor.*

Biol. 120. Physiology (3)

Recitations and demonstrations covering the principles underlying the operation of life-processes. The subject matter is not limited to any one group of organisms, but is derived from living things in general. *Prerequisite: Consent of instructor.* Second semester.

For Advanced Undergraduates and Graduates

Biol. 206. Natural History and Ecology (3)

Identification and life habits of local plants and animals; laboratory training in the use of analytical keys and of collections of reference, and the correct methods of making collections; trips to local regions of natural interest for field identification and study of interrelationships of living organisms; conservation, conservation programs, and appreciation of nature. Two lectures and one field trip per week. Mr. Trembley

Biol. 313. Histology (3)

The techniques of preservation and preparation of animal tissues for microscopical study; comparative studies of fresh and preserved vertebrate tissues. One lecture and two laboratory periods per week. *Prerequisite: One semester of vertebrate zoology with laboratory.* Second semester.

Mr. Owens

Biol. 353. Advanced Bacteriology (3)

A comprehensive course in the nature of Rickettsiales, Virales and bacterial viruses, dealing with scope, habitat, evolution, taxonomy, physical and chemical properties. *Prerequisite: One semester of bacteriology.*

Mr. Grainger

Biol. 355. Industrial Bacteriology (3)

An advanced laboratory course in bacteriology including aspects of industrial chemistry in which bacteria play an essential part in the process, as in the manufacture of acetone, butanol, acetic, and lactic acids. *Prerequisites: One semester of bacteriology and analytical chemistry.*

Mr. Parker

Biol. 358. Immunology (3)

A comprehensive recitation course in the study of the antigen-antibody reaction as a broad biological phenomenon. Emphasis is laid on the fundamental response of the tissue cell to foreign substances rather than on any medical application. *Prerequisite: One semester of bacteriology.* First semester.

Mr. Thomas

Biol. 361. Public Sanitation (3)

A laboratory and field study of the biological, chemical, bacteriological, and physical aspects of public water supplies, systems of sewage disposal, and milk distribution. *Prerequisites: One semester each of bacteriology and analytical chemistry.* First semester.

Mr. Thomas

For Graduates

Prerequisite for graduate work in biology: the amount of biology usually required for an undergraduate major in that department. Prerequisite for graduate work in bacteriology: a satisfactory undergraduate course in bacteriology and sufficient preparation in organic chemistry. Ability to undertake graduate work must be demonstrated by previous scholastic record, an examination, or both.

Biol. 403. Vertebrate Histogenesis and Organogenesis (3)

Careful laboratory work on the development of a vertebrate; tracing of the history of the germ-layers, organs, and tissues; the association of tissues to form organs. First semester.

Mr. Owen

Biol. 407. Biological Research (3)

Investigation in any phase of the biological sciences according to the student's preparation and interests. First semester.

Messrs. Grainger, Owen, Parker, Thomas, Trembley

Biol. 408. Biological Research (3)

Continuation of Biol. 407. Second semester.

Messrs. Grainger, Owen, Parker, Thomas, Trembley

Biol. 409. Advanced Morphology (3)

A laboratory course in special phases of morphology, such as comparative osteology, comparative morphology, or embryology of the vertebrates, etc., to meet the individual interest of the student. First or second semester.

Mr. Owen

Biol. 410. Biological Theories (3)

An advanced course in genetics and evolution. First semester.

Messrs. Thomas, Trembley

Biol. 411. General Cytology (3)

Conference, assigned readings, and laboratory work on the structural features of the cell in relation to cellular function and on modern methods of preparing living and fixed tissues for cytological study. *Prerequisites: Biol. 313 or equivalent.* First or second semester.

Mr. Owen

Biol. 412. Field Zoology (3)

Methods of biological survey work; animal censuses; collection, preparation, and care of zoological specimens; the use of keys; study of the interrelationships existing between the groups of local animals, especially the vertebrates, and of their habitat preferences. Lectures, laboratory work, and field trips. Second semester.

Mr. Trembley

Biol. 413. Problems in Field Zoology (3)

Concentrated work in the life history study of one or more local species. To be taken concurrently with or following Biol. 412 depending upon the previous experience and interest of each student. First or second semester.

Mr. Trembley

Biol. 430. Antibiotic Substances (3)

Fundamentals of the interrelationships among microbial populations; preparation and evaluation of penicillin and similar substances. Two lectures and one laboratory period per week. *Prerequisites: Biol. 61, Chem. 150 or their equivalents.* Second semester.

Mr. Parker

Biol. 456. Industrial Mycology (3)

An advanced laboratory course in mycology, including aspects of industrial chemistry in which yeasts and molds play an essential part in the process, such as in the manufacture of industrial alcohol, citric acid, etc. *Prerequisite: Biol. 355 or equivalent.* Second semester.

Mr. Parker

Biol. 460. Serology (3)

A laboratory course in the preparation of antigens, immunization of animals, and the study of antigen-antibody reactions. To be taken concurrently with or following Biol. 358. First or second semester.

Mr. Thomas

Biol. 462. Microbiology (3)

A recitation and laboratory course in the study of the higher bacteria, yeasts, molds, algae, and protozoa of interest to the bacteriologist. Practical applications to sanitary bacteriology, water supplies, sewage disposal systems and food spoilage. First or second semester.

Mr. Parker

Biol. 463. Physiology and Chemistry of Bacteria

The biochemistry of bacterial metabolism, zymology, respiration, nutrition, reproduction. First or second semester.

Mr. Grainger

Biol. 464. Epidemiology (3)

A seminar dealing with historic epidemics of typhoids, cholera, plague, diphtheria, and the venereal diseases; the methods of transmission of the organisms concerned with mass infections; modern immunological and sanitary practice in prevention. First or second semester. Mr. Grainger

Biol. 465. Industrial Biology (3)

A laboratory course in the preparation and standardization of biological products used in active immunization, diagnosis, and serum therapy. *Prerequisite: Biol. 358.* First or second semester.

Messrs. Grainger, Thomas

Biol. 466. Public Health Administration (3)

The organization of national, state, and local health services; relationship between official and volunteer health agencies; functions of medical health officer, epidemiologist, public health nurse, and sanitary inspectors in a public health program; various phases of health work such as eugenics, personal, social and industrial hygiene, sanitation, vital statistics, and public education. First or second semester.

Mr. Thomas

Biol. 467. History of Bacteriology (3)

Reading, conferences, and written reports. First or second semester.

Mr. Thomas

Biol. 468. History of Biology (3)

Reading, conferences, and written reports. First or second semester.

Mr. Trembley

BUSINESS ADMINISTRATION

A candidate who is a graduate, with a major in business administration, of an approved college; and who has had basic courses in accounting, business cycles, business law, corporation finance, economics, labor problems, marketing, money and banking, and statistics, will usually have sufficient background work to enable him to complete the requirements for the M.B.A. degree in one year. For other candidates an additional semester or year devoted to prerequisite and basic courses may be necessary.

Fin. 421 Financial Management (3)

A case study of the financial policies of management. *Prerequisite: Preparation in finance acceptable to the instructor.* First semester. Mr. Schwartz

Acctg. 422. Managerial Accounting (3)

Managerial use of accounting data with special attention to budgets and to statement analysis. *Prerequisite: Preparation in accounting acceptable to the instructor.* Second semester.

Mr. Moore

Eco. 431. Managerial Economics (3)

Problems of the Business Enterprise: Product selection, output, pricing and capital budgeting, analysis of cost and demand functions in markets of various types and under various general business conditions. *Prerequisite: Consent of the instructor.* First semester Mr. Urban

Eco. 433. Labor Management Economics (3)

A study of industry as a problem of group relations. Collective bargaining techniques, procedures and problems. Federal and state legislation. *Prerequisite: Consent of the instructor.* First semester Mr. Diamond

Fin. 442. The Money Market (3)

A study of the markets for short-term funds in the United States with particular emphasis on the New York markets for bank acceptances, commercial paper, loans to brokers, and U. S. Government obligations. The relation of Federal Reserve policy to interest rates and the supply of funds will also receive detailed attention. Second semester. Mr. Bradford

Eco. 450. Marketing Management (3)

A study of the factors affecting consumer demand and methods of satisfying it; the structure of the market; marketing methods and problems of various agencies; competitive practices; the management of the selling activities of a business, distribution policies, pricing, and the planning of marketing operation. Second semester. Messrs. Snider and Walters

E.S. 454. Forecasting (3)

A study of the methods of forecasting with special attention to secular and cyclical forecasting. *Prerequisite: E.S. 346, 347.* Second semester. Mr. Bratt

Eco. 490. Thesis in Business Administration (3)

Subjects for theses may be in the fields of accounting, economics, economic statistics, finance or marketing. First and second semesters. Staff

All of the above courses except the thesis will be required of all candidates for the M.B.A. degree. Eco. 490, Thesis in Business Administration, may be required at the discretion of the Graduate Committee of the College of Business Administration. There will be required also an additional 9 credit hours (6 credit hours if a thesis is required), to be selected in consultation with an adviser, from the following: "300" courses in the Accounting, Economics and Sociology, and Finance Departments; "200", "300", and "400" courses in other departments, of which not more than 6 credit hours may be in the "200" group. A comprehensive examination will be required of all candidates for the M.B.A. degree.

For additional graduate courses in Business Administration, see Accounting, Economics and Sociology, and Finance.

CHEMICAL ENGINEERING

Professors Foust and Simmons

Assistant Professors Wenzel, Maus and Andersen

Mr. Pasquali

Ch.E. 70. Industrial Stoichiometry (3)

Chemical and physical calculations upon which energy and material balances are based, and application of these balances to various industrial processes, involving vaporization and condensation, fuels and combustion. Applications are picked from a wide variety of chemical processes. *Prerequisites: Math. 13; Chem. 35; Phys. 23, previously or concurrently.* First semester.

Ch.E. 100. Industrial Employment (0)

During the summer following the junior year candidates for the degree of B.S. in Chemical Engineering are required to obtain industrial experience through employment for at least eight weeks in a plant or laboratory, or engineering office.

Ch.E. 160. Industrial and Engineering Chemistry (3)

Introduction to chemical engineering principles through a study of unit operations and processes in various chemical industries. *Prerequisites: Chem. 36; Math. 12 or consent of instructor.* Second semester.

Ch.E. 171. Unit Operations I (3)

A study of the fundamentals of materials-handling including size reduction and separation of solids, and transportation thereof. Principles of fluid flow, including classification, sedimentation, flow measurements, flow thru pipes, flow thru packed beds, filtration, centrifugation and fluidization; and introduction to the equilibrium stage operations of chemical engineering. *Prerequisite: Ch.E. 70.* First semester.

Ch.E. 172. Unit Operations II (3)

A continuation of Ch.E. 171, through the equilibrium stage operations of solid-liquid extraction, liquid-liquid extraction and distillation, and into the rate operations of heat transfer. Three lectures. *Prerequisite: Ch.E. 171.* Second semester.

Ch.E. 173. Unit Operations III (3)

A continuation of Ch.E. 172. A study of those operations controlled by the rate of heat and mass transfer. These include heat transfer, evaporation, crystallization, drying, gas absorption and humidification. Two lectures and one laboratory. *Prerequisite: Ch.E. 172.* First semester.

Ch.E. 174. Plant and Equipment Design (3)

A study of codes and specifications, safety and fire protection, water

supply, transportation, service facilities and other factors affecting the location and layout of plants and the design of process equipment. *Prerequisite: Ch.E. 172.* Second semester.

Ch.E. 175. Chemical Engineering Practice (1)

Comprehensive studies in nearby manufacturing plants of processes involving one or more unit operations. *Prerequisite: Senior standing.* Second semester.

Ch.E. 176. Chemical Engineering Projects (2)

Special study of a particular problem involving laboratory and library work. Topics include equipment design, construction and testing; research in unit operations, unit processes, thermodynamics and kinetics; data correlation. Weekly conferences and reports. *Prerequisite: Ch.E. 173 previously or concurrently.* First and second semesters. Staff

Ch.E. 177. Unit Operations Laboratory (2)

One six-hour period per week. *Prerequisite: Ch.E. 173, previously or concurrently.* First semester. (Given first in 1955-56.)

For Advanced Undergraduates and Graduates

Ch.E. 200. Chemical Engineering Thermodynamics (3)

Energy relations and their application to chemical engineering. Consideration of flow and non-flow processes, evaluation of the effect of temperature and pressure on thermodynamic properties of ideal and actual fluids; prediction of the heat effects accompanying phase changes and chemical reactions; application to industrial processes. *Prerequisites: Ch.E. 70, Chem. 94, or equivalents.* Second semester.

Ch.E. 260. Engineering in Chemical Manufacturing (3)

A survey of operations and equipment common to chemical production, planned to acquaint non-chemical engineers with the procedures of chemical manufacturing, primarily in continuous processes. *Prerequisite: Consent of the instructor.* First semester.

Ch.E. 261. Applied Chemical Calculations (3)

This course is planned for those students majoring in Chemistry who contemplate an industrial career in chemical manufacturing. It treats the stoichiometry of industrial systems, thermodynamics of real fluids and the kinetics of constant pressure flow reactors. *Prerequisite: Chem. 190.* First semester.

Ch.E. 301. Process Design (3)

Technical and economic study of selected or proposed chemical processes. Flow diagrams, heat and energy balances, apparatus design, cost estimation; approximation methods for obtaining data. Lectures, discussions, comprehensive reports. The annual A.I. Ch.E. Contest Problem may be used as a part of the course requirements. *Prerequisite Ch.E. 173.* Second semester.

Ch.E. 302. Chemical Engineering Kinetics (3)

The application of chemical kinetics to the design and operation of reactors. Interrelations of kinetics, thermodynamics and unit operations in steady and unsteady states. *Prerequisites:* Ch.E. 173 previously or concurrently and Ch.E. 200; basic courses in chemical engineering. First semester.

Ch.E. 386. Chemical Engineering Process Control (3)

A study of the fundamentals of primary sensing elements and their application to the measurement, recording, and control of temperature, pressure, concentration, humidity, fluid flow rate, and other variables; discussion of telemetering systems, electronic and mechanical recording systems, pneumatic and electromechanical indicating and controlling elements. *Prerequisite:* Senior standing in a curriculum of the Engineering College, or consent of the instructor. Second semester.

For Graduates

Ch.E. 400. Chemical Engineering Thermodynamics (3)

Chemical engineering applications of thermodynamics. Topics include prediction of physical and chemical equilibrium, heat effects accompanying solution, flow of compressible fluids, refrigeration, vaporization, and condensation processes. *Prerequisites:* an introductory course in thermodynamics. First semester.

Ch.E. 402. Chemical Engineering Kinetics (3)

A continuation of Ch.E. 302. The application of chemical kinetics to the engineering design and operation of reactors. *Prerequisite:* Ch.E. 302 or equivalent. Second semester.

Ch.E. 450, 451. Special Topics in Chemical Engineering (3)

An intensive study of some field of Chemical Engineering not covered in more general courses. First or second semester.

Ch.E. 452, 453. Seminar in Chemical Engineering (3)

Critical discussion of recent advances in Chemical Engineering. First or second semester.

Ch.E. 480. Industrial Chemistry and Chemical Engineering Research (4)

Investigation of a problem in chemical engineering or in industrial chemistry. First semester.

Ch.E. 481. Industrial Chemistry and Chemical Engineering Research (4)

Continuation of Ch.E. 480. Second semester.

Ch.E. 482. Chemical Engineering (3)

Advanced consideration of chemical engineering energetics, hydrodynamics and heat transfer applied to filtration, classification, and extraction. First semester.

CHEMISTRY

Ch.E. 483. Chemical Engineering (3)

Continuation and amplification of Ch.E. 482. Studies in evaporation, refrigeration, and crystallization. Second semester.

Ch.E. 484. Chemical Engineering (3)

Continuation and amplification of Ch.E. 482 and 483. Studies in absorption and distillation. Given in alternate years. First semester.

Ch.E. 485. Chemical Engineering (3)

Continuation and amplification of Ch.E. 482 and 483. Studies in combustion, drying, hygrometry, and air conditioning. Given in alternate years. Second semester.

Ch.E. 488. Chemical Engineering Process Design (3)

The application of chemical engineering principles in the design of unit process equipment, involving such processes as evaporation, distillation, drying, filtration, and absorption and the coordination of such units into organized production.

Ch.E. 489. Chemical Engineering Process Design (3)

Continuation of Ch.E. 488.

CHEMISTRY

Professors Serfass, Neville, Ewing, Anderson
Amstutz and Zettlemoyer

Associate Professors Billinger and Fish

Assistant Professors Healey, Muraca, Kosower and West

Assistant Research Professors Stubbings, Walker and Meyers

Messrs. Kulp, Storrow, Jacobs, Keath, Burbach, Newman, Skewis
Bonsack, Stein, Richardson, Young
and Vanderryn

Chem. 4. General Chemistry (4)

The principles and applications of general chemistry; descriptive chemistry of the non-metals and their important compounds. One demonstration lecture, two recitations, one laboratory period. First and second semesters.

Mr. Serfass and Staff

Chem. 5. General Chemistry (4)

Continuation of Chem. 4. Principles and applications of general chemistry; descriptive chemistry of the metals and their compounds. One demonstration lecture, two recitations, one laboratory period. *Prerequisite:* Chem. 4. First and second semesters.

Mr. Serfass and Staff

Chem. 15. Elementary Chemistry (3)

An abridgment of Chem. 4. For students not majoring in science or engineering. Two lecture-recitations, one laboratory period. First semester.

Mr. Anderson

Chem. 16. Elementary Chemistry (3)

Continuation of Chem. 15; an abridgment of Chem. 5. Two lecture-recitations, one laboratory period. *Prerequisite: Chem. 15 or Chem. 4.* Second semester.

Mr. Anderson

Chem. 35. Analytical Chemistry (4)

Theory and practice of qualitative and quantitative analysis. Qualitative analysis by semi-micro methods; gravimetric and volumetric quantitative procedures. One lecture, three laboratory periods. *Prerequisites: Chem. 4 and 5.* First semester.

Mr. Muraca

Chem. 36. Analytical Chemistry (4)

Continuation of Chem. 35. Volumetric precipitation procedures; oxidation-reduction titrations; electrolytic and electrometric methods of analysis. One lecture, three laboratory periods. *Prerequisites: Chem. 4 and 5, Chem. 35.* Second semester.

Mr. Muraca

Chem. 38. Analytical Chemistry (3)

An abridgment of Chem. 35 for mining and metallurgical engineers. One lecture, two laboratory periods. *Prerequisites: Chem. 4 and 5.* First semester.

Mr. Muraca

Chem. 91. Physical Chemistry (3)

Introduction to physical chemistry; states of matter, change of state, solutions, surface phenomena; nuclear, atomic, and molecular structure. *Prerequisites: Chem. 4 and 5; Math. 13, previously or concurrently.* First semester.

Messrs. Healey, Zettlemoyer

Chem. 92. Physical Chemistry Laboratory (1)

Physical chemical measurements. To accompany Chem. 91. *Prerequisites: Chem. 35 or 38; Phys. 22; Math. 13, previously or concurrently.* First semester.

Mr. Healey

Chem. 93. Elements of Physical Chemistry (3)

Kinetic theory, change of state, solutions, equilibria, electrochemistry, colloidal phenomena. Especially designed for biology majors. *Prerequisites: Chem. 4 and 5.* First semester.

Mr. Fish

Chem. 94. Physical Chemistry (3)

Designed especially for engineering students with a working knowledge of the perfect gas laws. A study of states of matter, change of state, solutions, surface phenomena; nuclear, atomic and molecular structure. Introduction to thermochemistry. *Prerequisites: Ch.E. 70 or equivalent.* First semester.

Mr. Healey

Chem. 100. Industrial Employment

During the summer following the junior year candidates for the degree of B.S. in Chemistry are required to obtain industrial experience through employment for at least eight weeks in a plant or laboratory. Proposed employment must be approved in advance by the Director of the Curriculum, and a report covering this experience must be presented to him on or before the following January 8. Staff

Chem. 150. Organic Chemistry (3)

Systematic survey of the typical compounds of carbon, their classification and general relations; study of synthetic reactions. *Prerequisites: Chem. 5 and 35.* First semester. Mr. Amstutz

Chem. 151. Organic Chemistry (3)

Continuation of Chem. 150. *Prerequisite: Chem. 150.* Second semester. Mr. Amstutz

Chem. 165. Organic Chemistry Laboratory (2)

Preparation of pure organic compounds. *Prerequisites: Chem. 5; Chem. 35.* First semester. Messrs. Amstutz, Fish, Kosower

Chem. 167. Organic Chemistry Laboratory (2)

Continuation of Chem. 165 with particular emphasis upon aromatic compounds. *Prerequisite: Chem. 165.* Second semester. Messrs. Amstutz, Fish, Kosower

Chem. 175. Research Chemistry Laboratory (3)

Advanced study or an investigation involving intensive work in laboratory and library. Topics in active research include absorption, analytical processes, drying oils, industrial chemical processes, heterocyclic organic compounds, hydration of inorganic salts, kinetics of combustion, photomicrography, natural and synthetic resins, pigments, aldol syntheses, plastics, surface chemistry, tanning and leather technology, and X-ray technique. Second semester. Staff

Chem. 179. Literature of Chemistry and Chemical Engineering (1)

A systematic study of the reference books, journals, and general treatise with training in the use of the Library. Chronological development of the science with assigned reading and reports. Second semester. Mr. Billinger

Chem. 190. Physical Chemistry (3)

Continuation of Chem. 91. Study of the laws of thermochemistry, solutions, rates of reaction, and chemical equilibrium in homogeneous and heterogeneous systems based on thermodynamic and kinetic concepts. *Prerequisites: Math. 13, Chem. 91.* Second semester. Messrs. Zettlemoyer, Healey

Chem. 191. Physical Chemistry (3)

Continuation of Chem. 94. Study of the laws of thermochemistry solutions, rates of reaction, and chemical equilibrium in homogeneous and

heterogeneous systems based on thermodynamic and kinetic concepts. The laws of conductivity, current, electromotive force and energy relations of electrolytes in solutions. *Prerequisite: Chem. 94.* Second semester.

Mr. Healey

Chem. 192. Physical Chemistry Laboratory (1)

Continuation of Chem. 92. *Prerequisites: Chem. 91, Phys. 23; Chem. 92.* Second semester.

Mr. Healey

Chem. 194. Physical Chemistry and Electrochemistry (3)

Continuation of Chem. 190. The laws of conductivity, current electromotive force and energy relations of electrolytes in solutions and in the molten state. *Prerequisites: Math. 13, Chem. 190.* First semester.

Messrs. Zettlemoyer, Healey

Chem. 197. Electrochemistry Laboratory (1)

Experimental study of electrochemical reactions. Measurements of conductivity, current and electromotive force. *Prerequisites: Chem. 194, previously or concurrently; Chem. 190.* First semester.

Messrs. Ewing, Healey

For Advanced Undergraduates and Graduates

Chem. 302. Inorganic Chemistry (3)

Introductory consideration of chemical bonding; family relationships among the elements; systematic survey of inorganic chemical compounds their occurrence, properties, and reactions. *Prerequisites: eight hours of general chemistry.* Second semester.

Mr. West

Chem. 303. Nuclear and Radiochemistry (3)

An introductory survey of nuclear structure, the production and detection of radioactivity, and practical problems in the control of nuclear chain reactions. Stable and radioactive isotopes and their use as tracers in chemical investigations. *Prerequisite: three hours of physical chemistry.* Second semester.

Mr. West

Chem. 334. Radiation Methods (2)

The application of radiation methods, mainly X-ray methods, to chemical and industrial chemical problems. *Prerequisite: Consent of instructor.* First semester

Mr. Anderson

Chem. 335. Radiation Methods (2)

Continuation of Chem. 334. Amplification of X-ray diffraction methods; space groups; crystal chemistry. *Prerequisite: Chem. 334.* Second semester.

Mr. Anderson

Chem. 337. Advanced Analytical Chemistry (3)

One conference and two laboratory periods per week. *Prerequisite: eight hours of analytical chemistry.* Second semester.

Messrs. Serfass, Muraca

Chem. 339. Advanced Analytical Chemistry (2)

Similar to Chem. 357. Lecture and conference only. *Prerequisite: eight hours of analytical chemistry.* Messrs. Serfass, Muraca

Chem. 344. Radiation Methods Laboratory (1)

Laboratory in connection with Chem. 334. *Prerequisite: Consent of instructor.* First semester. Mr. Anderson

Chem. 345. Radiation Methods Laboratory (1)

Continuation of Chem. 344. *Prerequisite: Chem. 344.* Second semester. Mr. Anderson

Chem. 356. Quantitative Organic Analysis (1)

The practice of the common analytical procedures involving the quantitative estimation of carbon, hydrogen, halogen, nitrogen and sulfur; the iodine number method; the hydroxyl value; the acid value, and the saponification number. One laboratory period per week. *Prerequisites: eight hours of analytical chemistry; a course in organic chemistry.* Second semester.

Mr. Fish

Chem. 357. Qualitative Organic Analysis (3)

The theory and practice of the identification of pure organic compounds; preparation of derivatives and separation of mixtures of organic compounds. One lecture and two laboratory periods per week. *Prerequisite: one year of organic chemistry.* First semester.

Mr. Kosower

Chem. 358. Advanced Organic Chemistry (3)

The study of modern theories of reaction mechanisms and their application to the problems of organic chemistry. *Prerequisite: one year of organic chemistry.* Second semester.

Mr. Amstutz

Chem. 368. Advanced Organic Laboratory (2)

The synthesis and study of organic compounds. *Prerequisite: one year of organic chemistry.* First or second semester.

Messrs. Amstutz, Fish, Kosower

Chem. 371. Elements of Biochemistry (3)

An introduction to the study of carbohydrates, proteins, lipids, minerals and other substances and their importance in life processes. *Prerequisite: one year of organic chemistry.* Second semester.

Mr. Fish

Chem. 372. Advanced Biochemistry (3)

An intensive study of the chemistry and physics of carbohydrates, proteins and fats with emphasis on modern developments and theories. *Prerequisites: Three semesters of organic chemistry.* Second semester.

Mr. Fish

For Graduates

The prerequisites for graduate work in chemistry as a major study toward the doctorate or the master's degree are: inorganic

or general chemistry (8), analytical chemistry (8), organic chemistry (10), physical chemistry (8), physics (12), and mathematics, including calculus. Students of exceptional ability may be able to make up minor deficiencies while carrying graduate work. If the deficiencies are serious, a student can hardly expect to complete the requirements for the master's degree within the minimum time.

Chem. 400. Inorganic Chemistry Research (4)

Investigations in the field of inorganic and colloid chemistry.

Mr. West

Chem. 401. Inorganic Chemistry Research (4)

Continuation of Chem. 400. Second semester.

Mr. West

Chem. 402. Advanced Inorganic Chemistry (3)

Atomic structure and theories of valence; acid-base theories; study of the properties and reactions of certain elements, with emphasis on recent developments. Second semester.

Mr. Meyers

Chem. 403. Advanced Topics in Inorganic Chemistry (3)

Subjects of contemporary interest in inorganic chemistry, including organometallic compounds, metal complexes, co-ordination compounds, and carbonyls; acid-base theory and chemistry in nonaqueous solvents; and modern techniques used in inorganic chemistry. *Prerequisite: Chem. 302 or the equivalent.* First semester.

Messrs. Meyers, West

Chem. 430. Quantitative Analysis Research (4)

Investigation of problems in analytic procedures. First semester.

Messrs. Serfass, Muraca

Chem. 431. Quantitative Analysis Research (4)

Continuation of Chem. 430. Second semester.

Messrs. Serfass, Muraca

Chem. 432. Advanced Analytical Chemistry (3)

Theory of precipitation analysis; physico-chemical methods; micro-analysis; chromatography; organic-analytical reagents; accuracy and precision in analysis. *Prerequisite: eight hours of analytical chemistry.* Second semester.

Messrs. Serfass, Muraca

Chem. 433. Advanced Topics in Analytical Chemistry (3)

The theory of modern physico-chemical analytical techniques; discussion of optical and electrical instruments for use in research, including mass spectrometry. Raman spectrometry, infrared and ultraviolet spectrometry, electrometric titrations, polarography, radio-chemical instruments, etc.

Mr. Serfass

Chem. 436. X-ray Research (3)

The investigation of chemical and industrial problems by X-ray diffraction methods. First semester.

Mr. Anderson

Chem. 437. X-ray Research (3)

Continuation of Chem. 436. Second semester.

Mr. Anderson

Chem. 440. Advanced Physical Chemistry (3)

Definitions and fundamental laws of thermodynamics; statistical thermodynamics; chemical equilibria in homogeneous and heterogeneous systems; colligative and partial molal properties of solutions; electro-chemistry of solutions. *Prerequisite: one year of physical chemistry.* First semester.

Messrs. Healey

Chem. 441. Advanced Physical Chemistry (3)

Kinetic theory of gases, liquids, and solutions; reaction rate theory; heterogeneous reactions and catalysis; properties of dispersed systems; phenomena of surface chemistry; preparation and general properties of colloidal systems. *Prerequisite: one year of physical chemistry.* Second semester.

Mr. Zettlemoyer

Chem. 449. Seminar in Analytical and Physical Chemistry (1)

Reports and discussions of recent developments in analytical and physical chemistry.

Messrs. Ewing, Serfass, Zettlemoyer

Chem. 450. Theoretical Organic Chemistry (3)

A survey of current developments in the mechanisms of organic reactions, covering solvolysis, substitution, rearrangement, oxidation-reduction, and unstable intermediates. *Prerequisite: Chem. 358.* First semester.

Mr. Kosower

Chem. 451. Theoretical Organic Chemistry (3)

The application of physical concepts and methods to the study of organic molecules including acidity and basicity, infra-red and ultraviolet spectra, stereochemistry and conformation, kinetics, bond energies, and elementary valence theory. *Prerequisite: Chem. 358.* Second Semester.

Mr. Kosower

Chem. 452. Organic Chemistry, Heterocyclic Compounds (3)

The chemistry of thiophene, pyrrole, furan, pyridine, and their derivatives, considered from the viewpoint of recent organic theories of structure and reaction mechanisms.

Mr. Amstutz

Chem. 458. Topics in Organic Chemistry (3)

An intensive study of limited areas in organic chemistry. The subject of "Allylic Rearrangements" was covered in Spring 1955.

Messrs. Amstutz, Fish, Kosower

Chem. 459. Seminar in Organic Chemistry (1)

Reports and discussions of recent important developments in theoretical and applied organic chemistry.

Messrs. Amstutz, Fish, Kosower

Chem. 460. Organic Chemistry Research (4)

Investigation of a problem in organic chemistry. First semester.

Messrs. Amstutz, Fish, Kosower

Chem. 461. Organic Chemistry Research (4)

Continuation of Chem. 460. Second semester.

Messrs. Amstutz, Fish, Kosower

Chem. 463. Physical Organic Chemistry (3)

A study of the fundamental properties of organic molecules, including quantum-mechanical resonance, spectroscopy, dipole moments and thermodynamics; the use of these physical measurements in the solution of problems in organic chemistry.

Mr. Zettlemoyer

Chem. 466. Advanced Organic Preparations (2)

A laboratory course of instruction in advanced techniques of the preparation of organic compounds. First or second semester.

Messrs. Amstutz, Fish, Kosower

Chem. 471. The Chemistry of the Proteins (3)

A study of the proteins, amino acid, and nucleic acids, their properties, composition, degradation products, oxidation and other chemical reactions, synthesis, and analysis.

Mr. Stubbings

Chem. 472. The Chemistry of the Carbohydrates (3)

A study of the simple and complex sugars, starches, and cellulose, their synthesis, analysis, reactions, biological relations, occurrence, and industrial applications.

Mr. Stubbings

Chem. 473. Seminar in the Chemistry of Leather (1)

Reports and discussions of principles of protein chemistry and tanning processes as related to the production of leather.

Mr. Stubbings

Chem. 490. Physical Chemistry Research (4)

Investigation of a problem in physical chemistry. First semester.

Messrs. Zettlemoyer, Healey

Chem. 491. Physical Chemistry Research (4)

Continuation of Chem. 490. Second semester.

Messrs. Zettlemoyer, Healey

Chem. 493. Theoretical Chemistry, Kinetics (3)

Kinetics of explosions of solids; combustion and explosion of hydrogen and hydrocarbons; polymerization; kinetics of organic reactions. *Prerequisite: Chem. 441.*

Mr. Zettlemoyer

Chem. 495. Theoretical Chemistry, Thermodynamics (3)

Statistical theory of thermodynamics; heat capacity equations; quantum

theory in chemical thermodynamics. Reports and discussions on selected topics. *Prerequisite: Chem. 440.* Mr. Healey

Chem. 497. Surface Chemistry (3)

Applications of colloid chemistry; special topics in surface chemistry. Lectures and seminar. *Prerequisite: Chem. 441.* Mr. Zettlemoyer

Chem. 498. Advanced Physical Chemistry Seminar (3)

An intensive study of some field of physical chemistry.
Messrs. Ewing, Zettlemoyer

Chem. 499. Physical Chemistry Methods (2)

An advanced course in methods of physical chemistry laboratory practice.
Mr. Zeettlemoyer

CIVIL ENGINEERING AND MECHANICS

Professors Eney, C. D. Jensen and Beer

Associate Professors McPherson, Kolm, R. H. Snyder and Beedle

Assistant Professors, Muhlhausen, E. R. Johnston, deNeufville,

Strausser, Clement, Thurlimann, Ekberg, Smislova, Sami, Wan

Messrs. Errera, Driscoll, Ketter, Huber, Mathews, Misiaszek, Romanelli,

Stoscheck, Ritchie, White, deJesus, Fungaroli; Heimberger,

Shuga, Spalding

CIVIL ENGINEERING

C.E. 40. Land and Topographic Surveying (3)

The theory and practice of land surveying, including computation of areas, dividing land, map drawing, and topographic signs; field work with level and transit; theory and use of stadia. A recitation and seven hours of field work each week-day for three weeks. *Prerequisites: plane trigonometry. C.E. 61.* Summer session.

C.E. 41. Route Surveying (3)

Reconnaissance, preliminary and location surveys; theory and practice concerning simple, spiral, and vertical curves; railway switches; establishment of grades and setting of slope stakes; mass diagrams. *Prerequisite: C.E. 41.* Summer session.

C.E. 42. Highway Engineering (3)

The location, construction, and maintenance of roads and pavements; highway design. *Prerequisite: C.E. 41.* First semester.

C.E. 43. Advanced Surveying (3)

Adjustment of instruments; investigation of systematic and observational errors; elements of least squares with application to surveying adjustment of level nets and triangulation; celestial observations; field work in triangulation, determination of azimuth, precise leveling, and with the plane table; photogrammetry. *Prerequisite:* C.E. 40. Second semester.

C.E. 60. Descriptive Geometry (1)

A brief course in the elements of descriptive geometry designed for those students who pass an anticipatory examination in engineering drawing (excluding descriptive geometry), but who require credit for C.E. 60 according to the terms of their programs. Second semester.

C.E. 61. Engineering Drawing and Descriptive Geometry (3)

The use of drawing instruments; instruction in engineering lettering; the theory and practice of mechanical drawing and descriptive geometry; complete working and assembly drawings; tracing and reproduction of drawings; intersections and developments. The student who presents evidence of training in engineering drawing may take an anticipatory examination (excluding descriptive geometry) and receive two semester hours credit, if successful in passing the examination. See C.E. 60. First and second semesters.

C.E. 100. Industrial Employment

During the summer following the junior year, students are required to spend at least eight weeks in approved shop work or on engineering construction. A written report on the shop work or project, outlining the experience obtained is due on return from Christmas recess. The reports should contain plans, photographs, or calculations, as each case may require.

C.E. 101. Foundations (2)

Study of the design and construction of foundations for bridges and buildings. *Prerequisites:* C.E. 139, C.E. 153. Second semester.

C.E. 102. Civil Engineering Proseminar (1)

A study of current civil engineering projects and developments with written reports. At weekly meetings these reports are presented orally in abstract. *Prerequisite:* senior standing. Second semester.

C.E. 103. Special Problems (2-4)

Supervised individual research problems with report. *Prerequisite:* consent of instructor. First or second semester.

C.E. 104. Readings in Civil Engineering (1-3)

Study of selected technical papers with abstracts and reports. *Prerequisite:* consent of instructor.

C.E. 106. Structural Design (3)

Elementary theory and design of structures in steel, wood and concrete. An abridged course in stress analysis and design for students other than civil engineers. *Prerequisite: Mech. 111.* Second semester.

C.E. 107. Structural Welding (1)

The design of welded steel structures together with a study of current literature. A few periods will be devoted to the manual operation of making welds. *Prerequisite: senior standing in civil or mechanical engineering.* Second semester.

C.E. 139. Soil Mechanics (3)

An introduction to the study of the mechanics of soils, including soil classification, permeability, compressibility, shear strength, bearing, capacities, stability of embankment. *Prerequisite: Mech. 111.* First semester.

C.E. 140. Transportation Engineering (3)

Study and design of transportation facilities, including highways, airways, railroads, and waterways, with emphasis on highway and airport design. Laboratory work includes studies of the suitability of various soils for subgrades. *Prerequisites: C.E. 42; Mech. 121.* Second semester.

C.E. 150. Structural Analysis (4)

Algebraic and graphic determination of stresses in roof and bridge trusses under dead, live, and wind loads. *Prerequisite: Mech. 111.* Second semester.

C.E. 151. Structural Theory (3)

Introductory course in the theory of structural steel design including riveted and welded connections, pins, tension members, columns, and beams. *Prerequisites: C.E. 150; Mech. 112.* First semester.

C.E. 152. Structural Design (3)

Advance course in the analysis and design of several complete structural steel structures including a rolled beam bridge, a plate girder bridge, a truss highway bridge, a mill building and a tall office building. *Prerequisite: C.E. 151.* Second semester.

C.E. 153. Reinforced Concrete Theory (3)

Introduction to the theory and design of simple reinforced concrete structures. Laboratory work includes the preparation of concrete mixtures and tests of control cylinders, beams, and columns. *Prerequisites: C.E. 150; Mech. 112.* First semester.

C.E. 160. Water Works Engineering (3)

Theory and design of water supply, purification, pumping, transmission and distribution works. *Prerequisites: Mech. 121; Geol. 6.* First semester.

C.E. 161. Sewage Works Engineering (3)

Theory and design of sanitary and storm sewerage systems and of sewage treatment plants. *Prerequisite: Mech. 121 (Desirable preparation C.E. 160).* Second semester.

For Advanced Undergraduates and Graduates

C.E. 320. Hydraulic Engineering Projects (3)

Hydrology, analysis of design of earth and gravity dams, outlet structures, flood control methods, and flood routing. *Prerequisite: Mech. 121.* First semester. Mr. McPherson

C.E. 321. Water Power and Hydraulic Machinery (3)

Water power hydrology, turbine selection, model turbine tests; study of penstocks, flumes, surge tanks, control gates, etc.; pump selection and pump tests. *Prerequisites: Mech. 121, 123.* Second semester.

Mr. Strausser

C.E. 350. Advanced Structural Analysis (3)

An introduction to the study of stresses in indeterminate structures. *Prerequisites: C. E. 150, Mech. 112.* First semester.

Messrs. Eney, Kolm, Smislova

C.E. 351. Structural Design: Timber (2)

Analysis and design of timber columns, beams, tension members, trusses, connections, mechanical fasteners; study of allowable stresses, fire resistance and preservation of timber structures; project and timber tests with reports. *Prerequisite: C.E. 151.* Second semester. Mr. Eney

C.E. 353. Reinforced Concrete Design (3)

Application of the principles of continuity to the design of concrete structures, including buildings and rigid frame bridges. *Prerequisites: C.E. 153, C.E. 350.* Second semester. Messrs. Ekberg, Smislova

C.E. 360. Sanitation (3)

Study of those environmental factors having an influence upon public health, including food and milk sanitation; garbage and refuse collection and disposal; insect and rodent control; lighting, heating, and ventilating; plumbing; industrial hygiene; school sanitation; and swimming pools, but excluding water works and sewerage. *Prerequisite: Consent of instructor.* Second semester. Mr. Snyder

For Graduates

The following courses are open to engineering graduates only. The prerequisite for any course listed is a course of similar title on a less advanced level. Math. 417 and 418, Theory of Elasticity, Math. 429 and 430, Advanced Analytic Mechanics, Mech. 402, Advanced Analytical Mechanics, and M.E. 441 may be included in a graduate major.

C.E. 400. Research Methods (3)

Research procedures as applied to engineering materials and structures; methods of experimental stress analysis. First semester. Mr. Beedle

C.E. 401. Mechanical Methods of Stress Determination (3)

Use of mechanical devices in investigation of special problems, such as temperature deformations, foundation displacements, and integral action of structures; theory of similitude. First semester of alternate years. (*Offered Fall 1955*). Mr. Eney

C.E. 402. Structural Model Analysis (2-5)

Individual structural research problems, with report. *Prerequisite: C.E. 401*. Second semester of alternate years. (*Offered Spring 1956*)

Mr. Eney

C.E. 404. Structural Research (2-5)

Individual research problems with reports. First or second semester.

Staff

C.E. 405. Structural Welding (3)

The design of welded connections for buildings, rigid frames, and bridges, including costs, inspection, selection of electrodes, distortion effects, internal stresses, and a study of current research. Manual practice of arc welding. Given in alternate years. (*Offered Spring, 1955*).

Mr. Jensen

C.E. 406. Special Problems in Civil Engineering (3)

An intensive study, with report, of some special field of Civil Engineering. May be repeated for credit.

Staff

C.E. 407. Thesis (1-6)

Staff

C.E. 410. Advanced Analysis of Reinforced Concrete Structures (3)

Influence of shrinkage and plastic flow; plastic design (n-free analysis) composite beams, arch analysis considering secondary moments, stability, and interaction of arch and deck girders; prestressed concrete and its applications. First semester of alternate years. (*Offered Fall 1955*).

Mr. Ekberg

C.E. 411. Advanced Analysis and Design of Reinforced Concrete Structures (3)

Continuation of C.E. 410; design of reinforced concrete structures. Second semester of alternate years (*Offered Spring 1956*).

Mr. Thurlimann

C.E. 420. Run-Off and Stream-Flow (3)

Occurrence and distribution of water by natural processes. Analysis of climatological and stream flow data. Frequency and intensity of storms and floods. Storage and open channel problems. First semester of alternate years. (*Offered Fall 1956*).

Mr. McPherson

C.E. 421. Hydraulic Laboratory Practice (2-5)

Study of theory and methods of hydraulic experimentation simultaneously with laboratory work. First or second semester.

Mr. McPherson

C.E. 422. Hydraulic Research (2-5)

Individual research problems with reports. First or second semester.

Mr. McPherson

C.E. 439. Advanced Soil Mechanics (3)

Analysis of seepage beneath masonry dams and through earth dams; design of earth dams; consolidation and settlement analyses; shear testing methods and shearing strength of soil; stability of slopes. *Prerequisite: C.E. 139.* First semester of alternate years. (*Offered Fall 1956*).

Mr. Jensen

C.E. 440. Soils Research (2-5)

Individual research problems relating to soil mechanics, with reports. *Prerequisite: a course in soil mechanics.* First or second semester.

Mr. Jensen

C.E. 441. Foundation Engineering (3)

Soil Mechanics as applied to foundation engineering; bearing capacity of shallow footings, piers, and piles; soil problems relating to retaining walls; drainage prior to excavation; lateral supports in open cuts; design of foundations for airport runways. Second semester of alternate years. (*Offered Spring 1955*).

Mr. Jensen

C.E. 450. Advanced Structural Theory (3)

The design and investigation of statically indeterminate structures of steel and reinforced concrete, including arches. First semester.

Messrs. Eney, Kolm

C.E. 451. Advanced Structural Theory (3)

Continuation of C.E. 450. Second semester.

Messrs. Eney, Ekberg

C.E. 452. Structural Members and Frames (3)

Elastic and inelastic behavior of structures and their components. Problems in stress analysis, bending, torsion and stability. Desirable preparation; *Math. 221.* First semester of alternate years. (*Offered Fall 1956*).

Mr. Johnston

C.E. 453. Structural Members and Frames (3)

Continuation of C.E. 452. Second semester of alternate years. (*Offered Spring 1955*).

Mr. Johnston

C.E. 454. Plate and Shell Structures (3)

Analysis and design. Applications to both reinforced concrete and steel construction. Desirable preparation; *Math. 221.* First semester of alternate years. (*Offered Fall 1955*).

Mr. Thurlimann

C.E. 455. Structural Dynamics (3)

Response of structures to impact and vibration; application to engineering design. Desirable preparation. *Math. 221.* Second semester of alternate years. (*Offered Spring 1956*).

Mr. Johnston

C.E. 456. Graduate Seminar (1-3)

Study of current topics in the field of Civil Engineering. Given in alternate years. (*Offered Summer, 1956*).

Messrs. Eney, Beedle

C.E. 458. Plastic Analysis and Design (3)

Theory of plasticity and its applications to structural design. The behavior of steel structures beyond the elastic limit and up to collapse. Study of component parts of frames; methods of predicting strength and deformation in the plastic range. Studies of industrial type frames. Current research. Comparison of conventional design methods with plastic design techniques. First semester of alternate years. (*Offered Spring, 1956*).

Messrs. Beedle, Thurlimann

C.E. 460. Sanitary and Hydraulic Engineering (3)

Study of the design of reservoirs, tanks, and pipe lines for water supply systems, and of sewers and other appurtenances for sewage systems; inspection of existing plants, with reports thereon. First semester. (*Offered Fall 1955*).

Mr. Snyder

C.E. 461. Sanitary and Hydraulic Engineering (3)

Continuation of C.E. 460. Second semester. (*Offered Spring 1956*).

Mr. Snyder

MECHANICS

Mech. 1. Statics (3)

Composition and resolution of forces; analytical and graphical analysis of force systems in equilibrium; friction; center of gravity; moment of inertia. *Prerequisite: Math. 12 and Phys. 22 previously or concurrently*. First semester.

Mech. 2. Dynamics (3)

Kinematics and kinetics of translation and rotation, of plane motion; moment of inertia; relative motion; work; power; energy; impulse and momentum. *Prerequisites: Mech. 1; Math. 12; Phys. 22*. Second semester.

Mech. 3. Statics and Dynamics (3)

A condensation of Mech. 1 and Mech. 2. *Prerequisite: Math. 12; Phys. 22*. First and second semesters.

Mech. 111. Mechanics of Materials (3)

Strength and elasticity of materials; theory of stresses and strains; deflection of beams and shafts; torsion; buckling of struts. *Prerequisites: Mech. 1 or Mech. 3; Math. 13 previously or concurrently*. First and second semesters.

Mech. 112. Advanced Mechanics of Materials (3)

Further topics in column and beam theory, including unsymmetrical bending, combined stresses, conjugate beam methods; curved beams, impact loading, buckling. *Prerequisite: Mech. 111*. Second semester.

Mech. 113. Materials Testing Laboratory (1)

Experiments on wood, iron, and steel to determine the action of materials under stress and to study the physical properties of materials of construction. *Prerequisite:* Mech. 111, preferably concurrently or previously. First and second semesters.

Mech. 121. Mechanics of Fluids (3)

The behavior of real fluids and the more important physical laws; potential flow, laminar flow, boundary layers, turbulence, and waves, with practical applications to flow through orifices, and to weirs and pipes, open channels, turbines and pumps. *Prerequisites:* Mech. 2 or 3; Math. 13. First and second semesters.

Mech. 123. Hydraulics Laboratory (1)

Experiments in the flow of water and in the testing of hydraulic machinery. *Prerequisite:* Mech. 121 concurrently or Ch.E. 171 previously or concurrently. First and second semesters.

Mech. 302. Advanced Dynamics (3)

Elements of vector analysis; application to equilibrium and motion of a point and a rigid body; fundamental dynamical theorems and their application to engineering problems, moving frames of reference, impulsive forces, gyroscopic motion; introduction to generalized coordinates, Lagrange's equations. *Prerequisites:* Mech. 2 or 3; Math. 206, or 207, or 219, or consent of instructor. Second semester. Mr. Beer

Mech. 321. Intermediate Fluid Mechanics (3)

Fundamental principles of fluid motion with emphasis on hydraulic applications. A continuation of Mech. 121. *Prerequisites:* Math. 14, Mech. 121. First semester. Mr. McPherson

For Advanced Undergraduates and Graduates

Mech. 325. Aerodynamics (3)

Fundamentals of fluid mechanics applied to wing and propeller theory and to the drag of airplane parts; the Prandtl theory of lift and drag; principles of similitude, with application to wind tunnel tests. *Prerequisites:* Mech. 121; Math. 206. First semester.

Messrs. Beer, deNeufville

Mech. 326. Aerodynamics (3)

Dynamics of the airplane; performance calculations; climbing, gliding, and other types of flight; theory of stability and control. *Prerequisite:* Mech. 325. Second semester. Messrs. Beer, deNeufville

*** For Graduates**

A graduate student majoring in Applied Mechanics is expected to possess a thorough knowledge of undergraduate mathematics

and mechanics. Math. 301, 315, and 322, and Mech. 302, or their equivalents, are considered as prerequisites for graduate work in Applied Mechanics. Any of these courses which have not been taken by the student as an undergraduate should be included in his graduate program. He may then be required to present a larger number of credits than the minimum required for graduation.

A graduate major in Applied Mechanics may include courses chosen from the following group: Math. 417 and 418, Theory of Elasticity; C.E. 400, Research Methods; C.E. 452, Structural Members and Frames; C.E. 454, Plate and Shell Structures; C.E. 455, Structural Dynamics; M.E. 422, Advanced Compressible Flow; M.E. 442, Advanced Mechanical Vibration Analysis; Phys. 428 and 429, Methods of Mathematical Physics.

Mech. 402. Advanced Analytical Mechanics (3)

Fundamental dynamical theorems and their application to advanced problems; generalized coordinates, Lagrange's equations, fixed and moving constraints; non-holonomic systems, principle of least constraint; Hamilton's canonical equations, principle of least action; general methods of integration of the dynamical equations, integral invariants, Poisson brackets. *Prerequisite: Mech. 302; Math. 206; on consent of instructor.* Second semester. Mr. Beer

Mech. 421. Hydrodynamics (3)

Mathematical theory of fluids; potential; two and three-dimensional flow problems. *Prerequisite: Math. 206; on consent of instructor.* First or second semester. Mr. Beer

CLASSICAL LANGUAGES

Professor Crum

Associate Professor Maurer

GREEK

Gk. 1. Elementary Greek (3)

For all students who desire to obtain a knowledge of the fundamentals of the Greek Language. Early in the semester there will be reading in stories and legends in easy Greek. First semester.

Gk. 2. Elementary Greek (3)

Continued work in Greek vocabulary, forms, and syntax. Selections from Xenophon's *Anabasis*. *Prerequisite: Gk. 1.* Second semester.

Gk. 3. Second-Year Greek (3)

Anabasis; Iliad (if time permits): grammar and simple composition. *Prerequisites: Gk. 1 and 2, or one year of entrance Greek.* First semester.

Gk. 4. Second-Year Greek (3)

Continuation of Gk. 3. Second semester.

Gk. 7. Thucydides (3)

One or more books. Composition. *Prerequisite: Gk. 4.* First semester.

Gk. 8. Tragedy (3)

Euripides: *Medea, Bacchae*, or another play; Sophocles: *Oedipus Tyrannus, Antigone*, or another. Literary study of the drama; poetical language, style, and conception; metrical reading; composition. *Prerequisite: Gk. 4.* Second semester.

Gk. 9. Dramatic Poetry (3)

Aeschylus: *Agamemnon* or *Prometheus Bound*; Aristophanes: *Clouds, Frogs*, or *Birds*; Aristophanes as humorist and as moralist, with consideration of the tendencies which he satirized; metres; elementary text-criticism. *Prerequisites: Gk. 4 and consent of head of department.* First semester.

Gk. 10. Greek Oratory (3)

Selections from the earlier Attic orators and Demosthenes. Rapid reading, the student being supposed to have reasonable facility in understanding the Greek directly without rendering into English. Attention is directed largely to those points which illustrate the development of Greek prose style. *Prerequisites: Gk. 4 and consent of head of department.* Second semester.

Gk. 21. Ancient History (3)

The development of civilization from palaeolithic times to the world empire of Alexander the Great. The social, economic, religious, philosophic, artistic, and literary development of the ancient world; the origin of political institutions. First semester.

Gk. 99. Ancient Science (3)

A study of the architecture, mining, machinery, medicine, husbandry, etc., as developed by early peoples, especially by the Greeks and the Romans. A comprehensive view of the knowledge and use of natural resources. No knowledge of the Greek or Latin language is required. Second semester.

Gk. 111. Homer (3)

Rapid reading of considerable portions of the *Iliad* or the *Odyssey*. Homeric language, syntax, and metre. *Prerequisites: Gk. 4 and consent of head of department.* First semester.

Gk. 116. Plato (3)

Euthyphro, Apology, or other shorter dialogues. Grammar and composition. *Prerequisites: Gk. 4 and consent of head of department.* Second semester.

Gk. 183. The Economic and Social Life of the Greeks (3)

A study of the activities of the Greeks with special reference to domestic arts, religion, athletics, warfare, medicine, education, social customs, and commerce; numismatics and vase painting. Lectures, collateral readings, and reports. No knowledge of the Greek language is required. First semester.

For Advanced Undergraduates and Graduates

Gk. 200. Greek Literature in English Translation (3)

The development of the major departments of Greek literature; required readings in English translations, with special attention to the epic, drama, and lyric poetry. No knowledge of the Greek language is required. First or second semester.

Gk. 202. Greek Archaeology (3)

Aims and methods. A chronological presentation of prehistoric civilizations including the Neolithic, Minoan, Helladic, and Mycenaean periods. A study of extant ancient monuments, buildings, and city plans of important sites of the classical and Hellenistic periods. Lectures, collateral readings, and reports. No knowledge of the Greek language is required. Second semester.

LATIN

Lat. 22. Ancient History (3)

Continuation of Gk. 21. The Hellenistic Age. Rome from its origin to 395 A.D. Second semester.

Lat. 61. Beginning Latin (3)

For all students who desire to obtain a knowledge of the fundamentals of the Latin language. Special emphasis on English derivations and the principles of grammar. First semester.

Lat. 62. Caesar (3)

The Gallic War, Books I-IV. Prose composition and syntax. *Prerequisite: Lat. 61.* Second semester.

Lat. 63. Caesar (3)

Selections from the later books of the *Gallic War* or from the *Civil War*. Prose composition and syntax, with emphasis on clause construction. *Prerequisite: Lat. 62 or 2 entrance units.* First semester.

Lat. 64. Cicero (3)

Continuation of Lat. 63. Cicero's orations and either *de Senectute* or *de Amicitia*. *Prerequisite: Lat. 63.* Second semester.

Lat. 65. Vergil (3)

Vergil: *Ecllogues* and *Aeneid* I-IV; selections from Ovid. Practice in reading aloud and scansion; training in sight translation; the mythology and religion of Greece and Rome; the influence of Latin poetry upon English literature. *Prerequisite: Lat. 64 or at least three entrance units.* First semester.

Lat. 66. Horace (3)

Selected Odes. Lectures on the history and development of lyric poetry; constant practice in reading the more important metres; memorization of stanzas and passages. *Prerequisite: Lat. 65 or consent of head of department.* Second semester.

Lat. 67. Livy (3)

Selections from earlier books. Some study of early Roman history and topography. Selected poems of Catullus. *Prerequisite: Lat. 66 or consent of head of department.* First or second semester.

Lat. 68. Latin Drama (3)

Drama among the Romans; native dramatic performances; indebtedness to Greek drama; the various dramatic forms and their vogue; chief writers; dramatic festivals; the Roman theatre; influences on later literature. Reading of selected plays of Plautus, Terence, and Seneca. *Prerequisites: Lat. 66 and consent of head of department.* First or second semester.

Lat. 106. Roman Prose Writers of the Empire (3)

Selections from the following: Petronius, *Cena Trimalchionis*; Apuleius, Cupid and Psyche story from the *Metamorphoses*; Suetonius, *Lives*; Seneca, *Moral Epistles* and *Dialogues*; Tacitus, *Germania*. *Prerequisite: Lat. 68 or consent of head of department.* First or second semester.

Lat. 108. Lucretius (3)

The finest literary passages and selected passages illustrating his philosophy. Ennius and some study of early Roman epic. Vergil's sixth *Aeneid*; an intensive study of its debt to Greek literature, religion, and philosophy, and its influence on modern literature. Lectures on the history of the epic; collateral reading in the great epics of other literatures. *Prerequisite: Lat. 68 or consent of head of department.* First or second semester.

Lat. 169. Satire (3)

Selected satires of Horace and Juvenal. Lectures on the history of Roman satire and its influence on modern literature; study of social conditions under the empire. *Prerequisites: Lat. 66 and consent of head of department.* First and second semesters.

Lat. 170. Medieval Latin (3)

Selected readings from the works of late Latin writers. *Prerequisites:* Lat. 66 and consent of head of department. Second semester.

Lat. 184. The Economic and Social Life of the Romans (3)

A general survey of Roman life under the following heads: commerce, trade, industrial and domestic arts, agriculture, religion, athletics, amusements, warfare, medicine and surgery, education, marriage, funeral customs, costume, houses, and furniture. Lectures, collateral readings and reports. No knowledge of the Latin language is required. Second semester.

For Advanced Undergraduates and Graduates

Lat. 201. Latin Literature in English Translation (3)

A study of Latin literature by means of the best English translations. The lives of the most important authors are studied and their works read according to the major departments of literature—history, comedy, epic, lyric, etc. Emphasis is placed on the chronological development of the literature and historical background necessary to the interpretation of the author's works. Lectures and readings with special reports. No knowledge of the Latin language is required. First or second semester.

Lat. 203. Archaeology of Italy (3)

Neolithic, Terramare, Villanovan, and Etruscan cultures. Rome the City: its buildings, monuments, and streets, its destruction and rediscovery through excavation; origin and growth of the city; methods of identifying and dating monuments. A survey of Pompeii, Herculaneum, and Ostia. Lectures, readings, and reports. No knowledge of the Latin language is required. First or second semester.

ECONOMICS AND SOCIOLOGY

Professors Diamond and Jensen

Associate Professor Jacobi

Assistant Professors Bryski, Snider, Urban and Walters

Messrs. Fraser, Battis, Hughes, Levy and Toscano

ECONOMICS

Eco. 1. Industrial Evolution (3)

An introductory course outlining the gradual development of economic organization with special attention to the stages of economic progress and social institutions growing out of these stages. First semester.

Eco. 3. Economics (3)

A general course in the principles of economics, covering the fundamental forces governing the production, distribution, and consumption of wealth. The work deals with the basic institutions of economic life, the nature of production, the organization of productive enterprise, and the principles of value and price. *Prerequisite: sophomore standing.* First and second semesters.

Eco. 4. Economics (3)

A continuation of Eco. 3, in which the work deals with the principle of money and banking, the distribution of income, and important economic problems such as the business cycle, international trade, labor problems, social security, public finance, and alternative economic systems. *Prerequisite: Eco. 3.* First and second semesters.

Eco. 50. Economic Geography (3)

A survey of world resources and world trade, with special reference to the chief economic materials and the geographic and economic factors responsible for the position of the United States in the economic world. Second semester.

Eco. 111. Marketing (3)

A detailed and critical analysis of the principles of marketing, designed to acquaint the student with major institutions and functions involved in the distribution of goods and services from the producer to the consumer. *Prerequisite: Eco. 3.* First and second semester.

Eco. 113. Advertising (3)

The principles, practices, and problems of advertising with special reference to its social and economic aspects. *Prerequisite: Eco. 111.* First semester.

Eco. 115. Retailing (3)

A study of modern retail institutions; principles and methods of retail organization and management; economic, social, and legislative aspects of the retailing structure. *Prerequisite: Eco. 111.* Second semester.

Eco. 160. Insurance (3)

A non-mathematical course in the economic principles and business practice of insurance, particularly life, fire, and casualty insurance. *Prerequisite: Eco. 4.* Second semester.

For Advanced Undergraduates and Graduates

Eco. 214. Selling and Sales Management (3)

The principles and practices of modern selling and sales management; the function of distribution in modern management. *Prerequisite: Eco. 111, or consent of instructor.* Second semester.

Mr. Snider

Eco. 217. Industrial Marketing (3)

Analysis of the problems of industrial marketing; make-up of the product, market distribution, sales methods, advertising, etc., as differentiated from the marketing of consumer goods. *Prerequisite: Eco. 111 or consent of instructor.* First semester. Messrs Snider and Walters

Eco. 235. Transportation (3)

The economics of transportation by rail, highway, water, pipeline, and air; effects of transport costs on prices and on location of industries and markets; rate theory and practice; regulation, finance, government ownership, and coordination. *Prerequisite: Eco. 4.* First semester.

Mr. Bryski

Eco. 236. Public Utilities (3)

Rate-making, finance, combination, public ownership, federal power policy, and related problems in the electric, gas, and telephone industries. *Prerequisite: Eco. 4.* Second semester.

Mr. Bryski

Eco. 301. Business Management (3)

How various functional aspects of business are coordinated in the conduct of an enterprise. Designed to provide the student with an over-all perspective of the problems of management. *Prerequisite: Senior standing in business administration.* First and second semesters.

Mr. Urban

Eco. 306. Intermediate Economic Theory (3)

Determination of prices in terms of the equilibrium of the business enterprise and consumer choices in markets of varying degrees of competition; determination of wages, rent, interest, and profits; interactions of consumption, savings, employment, and income. *Prerequisite: Eco. 4.* First or second semester.

Mr. Davis

Eco. 307. Advanced Economics (3)

An advanced course in the principles of economics, dealing especially with the theory of the distribution of wealth, the nature of the productive process, the history of economic doctrines, and proposed plans for economic reform, such as socialism. *Prerequisite: Eco. 4.* First semester.

Mr. Davis

Eco. 308. Advanced Economics (3)

Continuation of Ecco. 307. *Prerequisite: Eco. 4.* Second semester.

Mr. Davis

Eco. 312. Marketing and Distribution Research (3)

Analysis of the techniques of marketing research: determination of research objectives; procedures involved in the conduct of marketing investigations. *Prerequisites: Eco. 111 and one other course in marketing.* Second semester.

Messrs. Snider and Walters

Eco. 333. Labor Problems (3)

The economics of labor; the history of labor movements in the United States, forms of labor organizations, and the methods and policies of trade unions. *Prerequisite: Eco. 4.* First and second semester.

Mr. Diamond

Eco. 334. Labor Problems (3)

A continuation of Eco. 333. The relations of labor to the courts; social and labor legislation; unemployment, employee health, accidents, personnel work, etc. *Prerequisite: Eco. 4.* Second semester. Mr. Diamond

Eco. 371. Readings in Economics (3)

Readings in various fields of economics, designed for the student who has a special interest in some field of economics not covered by the regularly rostered courses. *Prerequisite: Preparation in economics acceptable to the head of the department.* First semester.

Messrs. Davis, Diamond, Jensen, Snider

Eco. 372. Readings in Economics (3)

Continuation of Eco. 371. Preparation in Economics acceptable to the head of the department. Second semester.

Messrs. Davis, Diamond, Jensen, Snider

For graduate program see Business Administration

SOCIOLOGY

Soc. 41. Cultural Anthropology (3)

The development of nonliterate cultures and social organizations. A comparative study of primitive institutions and social patterns, including: marriage and the family, religion, economic activities, political organization, folklore and language. The significance of nonliterate cultures for an understanding of contemporary society. First semester.

Soc. 42. Principles of Sociology (3)

A course designed to introduce the student to the general field of sociology and familiarize him with the basic sociological concepts. Included are: group types, the mechanisms of group behavior, processes of social interaction, social structure, social institutions, social change, the individual and society. Second semester.

Soc. 44. The American Community (3)

Urban and rural communities in the United States, with emphasis on the urban community. Includes: Ecological patterns and growth, institutional organization, population characteristics and trends, social stratification, resources and problems, future development and planning. *Prerequisite: Soc. 42.* Second semester.

For Advanced Undergraduates and Graduates

Soc. 262. Social Problems (3)

Special problems of contemporary society, including population trends, crime, public health, poverty, child welfare, the handicapped, etc. Second semester. Mr. Diamond

Soc. 263. Introduction to Social Work (3)

The philosophy and practices of modern social work. Includes: social work as an institution, the fields of social work, private and public wel-

EDUCATION

fare, the support and control of agencies, case work and group work, community organization, social legislation. *Prerequisite: Soc. 42.* First semester. Mr. Jacobi

Soc. 264. The Family (3)

A sociological study of man's basic institution. Includes: an analysis of historical backgrounds, interactions within the family, relation to other groups and institutions; problems of family disorganization, legal aspects of marriage and divorce, family adjustment, the family in a changing society. *Prerequisite: Soc. 42.* First semester.

Messrs. Diamond, Jacobi

Soc. 266. Population Problems (3)

Quantitative and qualitative aspects of U. S. and world population. Includes: causes and effects of migrations, racial composition and race relations, population theories, legal aspects, social consequences of population, trends, present trends and future predictions. Second semester.

Messrs. Diamond, Jacobi

Soc. 271. Readings in Sociology (3)

Readings in various fields of sociology, designed for the student who has a special interest in some field of sociology not covered by the regularly rostered courses. *Prerequisites: Preparation in sociology acceptable to the head of the department.* First semester.

Messrs. Diamond, Jacobi

Soc. 272. Readings in Sociology (3)

Continuation of Soc. 271. *Prerequisite: Preparation in sociology acceptable to the head of the department.* Second semester.

Messrs. Diamond, Jacobi

EDUCATION

Professor H. P. Thomas

Associate Professors Bream* and Norris

Assistant Professors Peterkin, Hahn†, and F. G. Armstrong

Messrs. Hayward, L. R. Johnston, Watkins,

Neidig, Granger, Kelner, Prestwood, Shuman, R. Davis,

Geissinger, Tollinger, and Miss Fedder

Educ. 0. Effective Study Methods

A practical course in study techniques and in the tools of study: including reading and fundamentals of mathematics, as the needs of individual students may require. An extensive testing program is carried on

*On leave until September 1956.

†On leave 1954-55.

to assist the student in adjusting himself. *Prerequisite: consent of the instructor.* Second half of first semester.

Educ. A. Effective Study Methods (3)

A continuation of Educ. 0. *Prerequisite: Educ. 0.* Second semester.

Educ. 1. Introduction to Education (3)

A general introduction to the field of education, giving a broad survey of the work of the teacher and of the public schools: The aims, organization and materials of public education; the place of the Federal Government and the State in a program of public education; local problems, e.g., finance, law, buildings, personnel, school boards. Required for the Pennsylvania college provisional certificate. Should be taken during the sophomore year. First and second semesters.

Educ. 20. Educational Psychology (3)

An introductory course furnishing a psychological foundation immediately related to educational problems and practice. Practical problems involving analysis of designated material are assigned regularly for solution and report. Required for the college provisional certificate. Should be taken concurrently with Educ. 153 during the junior year. *Prerequisite: Psych. 1.* First semester.

Educ. 152. Principles of High School Teaching (3)

Basic methods of secondary instruction, including the objectives of education in relation to the curriculum; socialized procedure; problem-project method; contract plans; types of teaching related to different fields; directed study; organization of courses around criticized objectives; and the conduct of classes along the lines of individualized instruction. Recommended for the college provisional certificate. Should be taken concurrently with Educ. 154 during the junior year. *Prerequisite: Educ. 20.* Second semester.

Educ. 153. Observation of Secondary School Teaching (3)

Study, directed observation, and discussion of the various phases of teaching activity in high schools in or near Bethlehem. The class meets two hours each week. A minimum of 60 clock hours of directed observation and 15 clock hours of supervised practice teaching in the public schools is required. Required for the college provisional certificate. *Prerequisites: Educ. 1 previously or concurrently; Educ. 20 concurrently, consent of instructor.* First semester.

Educ. 154. Practice Teaching of Secondary School Subjects (3)

An intensive practical application of the principles of teaching to classroom conditions. The class meets two hours each week. A minimum of 75 clock hours of supervised practice teaching in the public schools is required. Students must have at least one free hour at the same time each day throughout the week. Required for college provisional certificate.

Prerequisites: Educ. 153 and 15 semester hours in the subject area in which the candidate expects to teach; Educ. 152 concurrently, consent of instructor. Second semester.

Educ. 156. Practice Teaching of Secondary School Subjects (3)

A continuation of Educ. 154. Teaching must be done in a field for which practice teaching credit has not been granted previously. *Prerequisites: Educ. 153 and 15 semester hours in the subject area in which the candidate expects to teach; consent of instructor. Educ. 154 may be taken concurrently. Second semester.*

For Advanced Undergraduates and Graduates

Educ. 321. The Diagnosis and Adjustment of Reading Difficulties (3)

The psychology of reading as related to learning difficulties; the fundamental skills of reading, including eye movements, the measurement and diagnosis of reading difficulties, and recent experiments with remedial procedure; practice in the development of material for remedial instruction. *Prerequisite: consent of instructor. First or second semester.*

Educ. 330. History of Education in Europe (3)

A survey of the Greek, Roman and early Christian periods; late mediæval and early modern periods; European movements since the French Revolution and their implications for American education. Second semester.

Educ. 331. History of Education in the United States (3)

The development of primary, secondary, and higher education in the United States; the aims, curricula, methods, and systems of education in relation to significant problems, economic changes, social conditions, and processes. First semester.

Educ. 350. Principles of Secondary Education (3)

An introductory course in the field of secondary education. The aims, organizations, and materials of secondary education; characteristics of secondary school pupils; and a general treatment of the problems of secondary education. Recommended for the college provisional certificate. *Prerequisite: consent of instructor. Second semester.*

Messrs. Peterkin and Tollinger

Educ. 351. Organization of Units of Instruction (3)

A practical course for the teacher in service, offering opportunity for cooperative planning of courses and units of instruction. Applying the principles of curriculum construction to the selecting, assembling, and organizing of learning experiences. The teacher is advised to work in his field of special interest. *Prerequisite: consent of instructor. Second semester.*

Educ. 360. Personnel Practices in Business and Industry (3)

A study of the techniques and principles used in the understanding and treatment of industrial problems confronting the line organization. Personnel administration as both a line and staff function. Case studies used for discussion of employee services, wage administration, and building, training and maintaining the labor force. *Prerequisite: consent of instructor.* Second semester. Messrs. Gould, Beach

Educ. 371. Elementary Educational Statistics (3)

Designed to give teachers and administrative officers the techniques necessary to enable them to gather data and present the results of their work in their classrooms and schools. Provides a practical knowledge of the simpler statistical methods for use in handling common problems and in understanding educational literature. *Prerequisite: consent of instructor.* First semester. Messrs. Armstrong, Thomas

Educ. 373. Diagnostic and Remedial Teaching (3)

The analysis and treatment of difficulties in the various subjects. The student may select any subject in which he has adequate background as his field of work. Practice is given in the development of materials, and actual work with failing pupils is expected. *Prerequisite: consent of instructor.* First semester. Mr. Norris

Educ. 390. Audio-Visual Education (3)

Types of audio-visual aids, the special value of each, their use in different subjects, the psychological basis for the use of such material, and the standards for the selection of these aids. Required for the permanent college certificate. First semester. Mr. Peterkin

Educ. 391-392. Workshop (3, 5, or 6)

Cooperative study of current educational problems. Designed to provide elementary and secondary school teachers an opportunity to work at their own teaching levels and in their own fields. Students will be limited to one workshop during a summer session but may eventually register for more than one, provided there is no duplication in subject matter. First or second semester. Mr. Hayward

For Graduates

The major in education on the graduate level is intended for students preparing for school administration and supervision and for other types of public school positions as well as for specialists in elementary and secondary education. Preparation is offered for such positions as superintendent of schools, supervising principal, elementary principal, secondary principal, and guidance counselor. All work is approved by the state councils of education of Pennsylvania and New Jersey.

At least four semester courses in education are prerequisite for a graduate major in this field. The prerequisites may be taken concurrently with a partial major program. Attention is called to Educ. 321, 330, 331, 350, 351, 360, 371, 373, and 390, all of which are open to advanced undergraduates and graduate students, and which may be taken as part of a major or as collateral work in education.

Educ. 419. Social Policy and Education (3)

A critique of the aims of education in the modern social order; the nature, needs, and adjustments of modern industrial society; the conflicting demands upon education by a changing civilization as represented by modern social points of view; the implications of contemporary American educational philosophy for democratic social progress. *Prerequisite: consent of instructor.* Second semester. Mr. Davis

Educ. 420. Advanced Educational Psychology (3)

Study and practice of techniques and methods involved in making a detailed psychological analysis of the pupil, particularly in relation to school problems. *Prerequisite: consent of instructor.* First or second semester. Mr. Peterkin and Miss Fedder

Educ. 421. Analytic and Remedial Reading Procedures and Practices (3)

A laboratory course in remedial procedures and practices in the teaching of reading. Provision is made for clinical practice with individual and small groups of children on the elementary or secondary level. Emphasis is placed upon the development of practical and informal techniques and materials for diagnosing reading difficulties and instructing retarded readers. First semester. Mr. Hahn

Educ. 422. Education of Exceptional Children (3)

Methods of instruction and provision of materials for children who differ markedly from the normal, i.e., gifted, subnormal, and maladjusted; the problems of the teacher in a system that makes little provision for the exceptional child. Actual case studies of pupils are required. *Prerequisite: consent of instructor.* First or second semester. Mr. Norris

Educ. 423. Psychology of School Subjects (3)

An analysis of the psychological development and behavior of pupils in connection with school subjects at all levels. Diagnostic work. Each student has an opportunity to emphasize the subject of his special interest. Mr. Norris

Educ. 426. Special Problems in Education (3)

Intensive study in an area of education not adequately covered in currently listed offerings. The field of research will be varied to meet the special needs of advanced students of unusual ability and adequate preparation. First and second semester. Staff

Educ. 432. Educational Sociology (3)

An analysis of the school as a social institution. This includes a consideration of man's cultural heritage and the function of education in preserving and improving it; group behavior relating to school problems; the integration of education with the life and institutions of the community and society; the social role of the teacher; social change and the school. First or second semester. Mr. Jacobi

Educ. 440. Principles of Elementary Education (3)

The aims, organization, and materials of elementary education; characteristics of elementary school pupils; and a general treatment of the problems of elementary education. First or second semester.

Educ. 443. Elementary School Administration (3)

The major problems of organization and administration of elementary schools; types of organization, pupil promotion, time allotment, service agencies, and plant and equipment. Required for a principal's certificate. First or second semester. Mr. Hayward

Educ. 444. The Elementary School Curriculum (3)

Problems of curriculum development in the first six grades; scope and sequence of learning experiences, program-making for different types of schools, units of instruction vs. special subjects, articulation, and similar problems. First or second semester. Messrs. Kelnor, Hayward, Norris

Educ. 446. Elementary School Supervision (3)

Methods, materials, organization, and evaluation of supervision. Each student will be required to develop a supervisory program for a subject or a school. First or second semester. Mr. Hayward

Educ. 447. A-F. Current Problems in Elementary School Subjects (3)

A. Reading and Language. B. Arithmetic. C. Social Studies. D. Science. E. Language Arts. F. Arts and Crafts. Selection, study and development of problems with reference to the various levels of the elementary school. Special attention will be given to the students' classroom problems. Classes will be limited to a consideration of one subject. First and second semesters. Mr. Hayward

Educ. 453. Secondary School Administration (3)

The major problems of organization and administration of secondary schools: program of studies, teaching staff, pupil personnel, plant and equipment, and community relationships. Required for a principal's certificate. *Prerequisite: Educ. 350 or its equivalent.* First or second semester. Messrs. Johnston, Granger

Educ. 454. The Secondary School Curriculum (3)

Related to Educ. 453, but organized in such a way that it may be taken independently. Methods of study of curriculum problems, the selection

of subject matter in various fields, the principles of program construction, and similar problems. *Prerequisite: Educ. 350 or its equivalent.* First or second semester. Messrs. Johnston, Norris, Peterkin

Educ. 456. Supervision in Secondary Schools (3)

Related to Educ. 453 and 454, but may be taken independently. The purpose of supervision, a program for the improvement of teaching, the evaluation of teaching, measurement, supervisory relationships, and similar problems involved in the supervision of instruction in secondary schools. *Prerequisite: Educ. 350 or its equivalent.* First or second semester.

Messrs. Johnston, Granger

Educ. 457. Modern Trends in Teaching (3)

Designed for the teacher in service and for principals who wish a knowledge of the most recent developments in the trends and techniques of teaching. Special attention is given to experimental studies in the field of method. Students will be sectioned on the basis of interest in elementary or secondary education. *Prerequisite: consent of instructor.* First semester.

Messrs. Hayward, Peterkin, Geissinger

Educ. 458. Extra-Curricular Activities (3)

A cooperative study in the philosophy and psychology supporting activity programs; their organization and administration. Emphasis will be given to the teacher's part in the program, e.g., clubs, student councils, homeroom and class organization, assemblies, publications, finance. First or second semester.

Messrs. Granger, Johnston

Educ. 463. Public School Administration (3)

A systematic treatment of the problems of administration, local, state, and national. The newer developments which are modifying educational administration: state authorization and organization, the board of education, the superintendent of schools, personnel management, business administration, financial support, and public relations. First or second semester.

Messrs. Thomas, Neidig, Watkins, Norris

Educ. 464. Foundations of Curriculum Construction (3)

Principles of curriculum construction which underlie the reorganization of the program of studies for elementary and secondary schools. Consideration of the origin and background of the curriculum, methods of organization, state, county, and city programs, curriculum planning and development, techniques for developing materials, and similar pertinent topics. First or second semester.

Messrs. Johnston, Norris, Peterkin

Educ. 466. Supervision of Instruction (3)

Analysis of the principles underlying the organization and supervision of instruction. Applications to specific teaching situations. No lines will be drawn between the elementary and the secondary school. First or second semester.

Messrs. Thomas, Johnston

Educ. 468. Vocational Education (3)

The social basis for vocational education; present practices and trends in the major types of vocational education; recommendations for organization and administration teaching problems; student employment; laws and regulations. First or second semester. Mr. Neidig, Shuman

Educ. 469 A-C. Evaluation of Public Schools (3)

Evaluation of all aspects of the school program in terms of its philosophy and objectives. Criteria will be studied and applied to the instructional program, student activities, guidance, and the library, the school staff, the school plant, and the school administration. Section A will deal with the elementary school. Section B will deal with the secondary school and Section C will deal with a survey of the public school system. First and second semesters. Staff

Educ. 472. Educational Tests and Measurements (3)

Selection of education tests, organization of a testing program, use of tests in classification, construction of classroom tests, use of tests in improving teaching, and diagnosis of pupil difficulties. Students will be sectioned on the basis of interest in elementary or secondary education. For advanced work in this field attention is called to the seminar and individual research courses. First or second semester. Mr. Armstrong

Educ. 482 A-B. Educational and Vocational Guidance (3)

a. General Introduction (2)

General principles of guidance. Discovery of interests and abilities, study of occupations, study of educational opportunities, guidance activities, group programs, student personnel problems.

b. Organization of School Programs (1)

Analysis and development of homeroom programs, school programs, and community programs. First or second semester. Mr. Granger

Educ. 483. Techniques of Counseling (3)

An intensive examination of personnel techniques including interviews, rating scales, and counseling by such means as lectures, demonstrations, and case histories. Case studies of selected students are required. Required for guidance counselor's certificate. First or second semester.

Messrs. Armstrong, Hahn

Educ. 484. Occupations (3)

Trends in supply and demand of workers in various occupations; requirements for occupations; sources of descriptive materials; testing for occupational aptitude. Required for guidance counselor's certificate. First or second semester. Mr. Shuman

Educ. 491-492. Seminars (3)

One seminar is organized in each half-year provided three or more students select such work. These courses do not duplicate the courses of individual research. It is the purpose of seminar courses to provide for

cooperative study of special problems in the field of elementary and secondary education. *Prerequisite: consent of instructor.* First and second semesters.

Messrs. Granger, Hayward, Johnston, Norris, Peterkin, Thomas

Educ. 493-494. Individual Instruction, Field Work, or Research (3)

Open to students with appropriate preparation and needs for pursuing independent investigation. The student must have shown interest in and capacity for advanced work in the chosen field, evidenced in part by an approved plan of work. *Prerequisite: consent of instructor.* First and second semesters.

Messrs. Congdon, Hayward, Johnston, Norris, Peterkin, Thomas, Watkins

Educ. 495-496. Seminar in School Administration (3)

Cooperative study of special problems in the field of school administration. Appropriate problems include: finance, building programs, public relations, teacher-personnel policies, business management, and school law. *Prerequisite: consent of instructor.* First and second semesters.

Messrs. Norris, Peterkin, Thomas, Watkins, Neidig

Educ. 497 A-D. Administrative Clinics (3)

This course, open only to a selected group of advanced students, will concern itself with an examination of duties and responsibilities of the various types of school administrators through analysis of literature, courses, institutional and state programs, and especially clinics with school administrators and representatives of state and national organizations. Students will be sectioned according to their primary interests as follows: Section A, elementary school principals, Section B, secondary school principals, Section C, guidance counselors, and Section D, superintendents of schools. First semester. *Prerequisite: consent of the head of the department.* Staff

Educ. 498. Internship (3)

A follow-up of Education 497 designed to give a limited number of advanced students an opportunity to obtain experience as administrative assistants in selected school systems. Conference hours for students and staff members will be devoted to discussion of work and problems encountered by students in their internships. Each student is required to submit a report describing and appraising experience gained in this internship. Second semester. *Prerequisite: consent of the head of the department.* Staff

ELECTRICAL ENGINEERING

Professors Bewley, A. R. Miller, and Mode

Associate Professor Karakash

Messrs. MacFarland, Teno and Jennes

E.E. 2. Direct Current Machinery (3)

Direct current circuits; magnetic circuits; direct current machine construction, operation, and control; generated voltages, forces on conductors, armature winding, machine characteristics. *Prerequisites: Phys. 24; Math. 13; Math. 14 concurrently.* Second semester.

E.E. 3. Direct Current Laboratory (1)

A coordinated laboratory course supplementing the classroom work in E.E. 2. Experimental studies and tests of direct-current machines and appliances, including characteristics, regulation, efficiency, etc. *Prerequisite: E.E. 2 concurrently.* Second semester.

E.E. 100. Summer Work

During the vacation following the junior year each student in electrical engineering is required to spend at least eight weeks getting practical experience in some approved shop or plant. A written report on the shop or plant, and the experience gained therein, is due on or before January 8. These reports should contain such calculations, photographs, drawings, and plots as each individual case may require.

E.E. 104. Alternating Current Circuits (3)

Alternating current conceptions; laws for series and parallel circuits containing R, L, and C; vector methods; complex quantities; single and polyphase circuits and networks; power; Fourier series; harmonics; superposition. *Prerequisites: E.E. 2, or E.E. 160 and 161; Math. 206 previously or concurrently.* First semester.

E.E. 105. Alternating Current Circuits Laboratory (1)

Supplements E.E. 104. Alternating current circuit experiments, with oscillographic studies. *Prerequisite: E.E. 104 concurrently.* First semester.

E.E. 106. Alternating Current Machines (3)

The electrical, magnetic, and mechanical features of single and polyphase transformers and induction motors. *Prerequisites: E.E. 104, E.E. 107 concurrently.* Second semester.

E.E. 107. Alternating Current Machine Laboratory (1)

Supplements E.E. 106. Laboratory tests on transformers, transformer banks, and induction motors. *Prerequisite: E.E. 106 concurrently.* Second semester.

E.E. 108. Alternating Current Machines (3)

A continuation of E.E. 106. The electrical, magnetic, and mechanical features of synchronous generators, motors, and converters. *Prerequisites:* E.E. 104; E.E. 109 concurrently. First semester.

E.E. 109. Alternating Current Machine Laboratory (2)

A continuation of E.E. 107, supplementing E.E. 108. Laboratory tests on synchronous generators, motors, and converters; measurement of constants; parallel operation, calculations. *Prerequisite:* E.E. 108 concurrently. First semester.

E.E. 110. Industrial Electronics (3)

A study of the fundamentals of electronic discharges in vacua and gases; operating characteristics of vacuum and gaseous tubes, mercury arc rectifiers, photoelectric cells, cathode ray oscillographs, industrial electronic control devices, etc. *Prerequisite:* E.E. 104 or Phys. 212. Second semester.

E.E. 111. Electrical Engineering Proseminar (1)

A weekly meeting for discussion of topics from the current journals of theoretical and applied electricity. Presentation of papers on assigned topics. *Prerequisite:* senior standing. Second semester.

E.E. 120. Industrial Applications (4)

Selected topics on motor applications, control devices, industrial electronics, electric traction, conversion apparatus, illumination, electric heating, electrolytic processes, and the economics of power. The emphasis placed on any one of these subjects will depend on the interests of the class. Separate sections may be formed to accommodate a variety of such interests. *Prerequisites:* E.E. 106, E.E. 108, E.E. 110.

E.E. 133. Transmission Lines (3)

Long distance transmission of power; determination of line constants; geometric mean distances; corona; interference; differential equations and solutions; general circuit constants; regulation; losses and efficiency; mechanical design of lines; economics of power transmission. *Prerequisites:* E.E. 106, E.E. 108 concurrently. First semester.

E.E. 141. Radio Communication (4)

The principles of radio communication; high frequency alternating currents, resonant circuits, and amplifier circuits; laboratory measurements on audio and radio circuits. *Prerequisite:* E.E. 110. First semester.

E.E. 142. Radio Communication (3)

Continuation of E.E. 141. A study of detection, oscillation, amplitude and frequency modulation, and television. *Prerequisite:* E.E. 141. Second semester.

E.E. 143. Wire Communication (3)

Introductory theory of networks; bridge and coupled circuits; impedance matching; telephone circuits; transmission lines at audio and carrier frequencies; communication apparatus. *Prerequisite: E.E. 110.* First semester.

E.E. 144. Wire Communication (3)

Continuation of E.E. 143. Wave filters, repeaters, corrective and balancing networks; electro-acoustics; laboratory measurements on wire communication circuits. *Prerequisite: E.E. 143.* Second semester.

E.E. 160. Electrical Circuits and Apparatus (3)

Theory and applications of direct-current and alternating-current circuits, electronics, and direct-current and alternating-current machines and apparatus. *Prerequisites: Math. 13, Phys. 24.* First or second semester.

E.E. 161. Electrical Problems (1)

A three-hour problem period to accompany E.E. 160. *Prerequisite: E.E. 160 concurrently.* First or second semester.

E.E. 162. Dynamo Laboratory (1)

Tests on direct and alternating-current circuits, apparatus and electronic devices. *Prerequisite: E.E. 160 concurrently.* First or second semester.

For Advanced Undergraduates and Graduates

E.E. 331. Electric and Magnetic Fields (3)

The calculation and construction of electric and magnetic fields for conductors, plates, vacuum tubes, slots, teeth, etc.; analogous problems in fluid flow. The methods of the theory of functions of a complex variable and of Fourier series and integrals are introduced in sufficient detail to serve in the analytical work; the rules for freehand plotting are derived and applied. *Prerequisite: E.E. 108.* Second semester. Mr. Bewley

E.E. 332. Electric Transients (3)

Electrical, mechanical, and heat flow transients of circuits, transmission lines, electrical machinery, and power systems; operational calculus, to include Fourier integral, Bromwich integral, Laplacian transform, and the direct operational method. *Prerequisite: E.E. 104.* First semester.

Messrs. Bewley, Mode

E.E. 334. Transmission Line Transients (3)

Traveling waves; free and forced oscillations; reflections; transition points; multi-conductor systems; multi-velocity waves; attenuation and distortion; lightning surges; switching surges; arcing grounds; protective devices; surges in transformer and machine windings. *Prerequisites: E.E. 133; E.E. 332.* Second semester. Mr. Bewley

E.E. 335. Symmetrical Components (3)

The solution of unbalanced polyphase circuits by means of symmetrical components; system faults, open-circuit and short-circuit currents and voltage calculations; sequence impedances of transmission lines, transformer banks, etc.; metering. *Prerequisite: E.E. 133 concurrently.* First semester.

Mr. Miller

E.E. 336. System Stability (3)

Steady state and transient power limits of transmission systems; electro-mechanical characteristics of electrical machines and networks. *Prerequisites: E.E. 335; E.E. 337 and 338 concurrently.* Second semester.

Mr. Miller

E.E. 337. Advanced Machine Theory (3)

The transient theory of A.C. machines; balanced and unbalanced conditions; time constants; approximate and rigorous solutions. *Prerequisites: E.E. 335; E.E. 332; and 338 concurrently.* Second semester.

Mr. Miller

E.E. 338. Transients Laboratory (1)

An oscillographic laboratory study of transmission line transients, system stability, and machine transients. *Prerequisite: E.E. 337 concurrently.* Second semester.

Mr. Miller

E.E. 345. Electromagnetic Theory (3)

Vector analysis; divergence, gradient, curl; Stokes' and Gauss' theorems; generalized coordinates; Maxwell's equations; Poynting's theorem; transmission, reflection and refraction of waves; retarded potentials; parallel, rectangular, and cylindrical wave guides; radiation from antennae; simple directive arrays; ground reflection. *Prerequisite: E.E. 104.* Second semester.

Messrs. Mode, Karakash

For Graduates

Graduate students intending to major in electrical engineering must have completed a program of study equivalent to that required for the B.S. in E.E. at Lehigh University.

Graduate courses are given to qualified men from the industries of the surrounding district.

The following subjects may be considered as a part of the major field for an M.S. in E.E.: Math. 405, 406, 416, 453, 417, 418, 429, 430, 431, and Phys. 420, 421, 422, 423, 428, 429.

E.E. 433. Tensor Analysis of Electric Circuits and Machines (3)

The application of dyadics, matrices, and tensors to the theory of electric circuits and machinery; static networks, networks theorems, vacuum tube circuits, transformers, and transmission lines. First semester.

Mr. Bewley

E.E. 434. Tensor Analysis of Electric Circuits and Machines (3)

Continuation of E.E. 433. The generalized machine; equations of motion, voltage, torque, small oscillations and power for holonomic, non-holonomic and quasi-holonomic reference systems; applications to all machines constituting special cases of the generalized machine; the equations of Lagrange, Maxwell, and Maxwell-Lorentz are used as starting points in the general theory. Second semester. Mr. Bewley

E.E. 435. Power System Stability (3)

Power flow in electric circuits; steady state power limits of systems having synchronous and asynchronous machines with salient poles or round rotors; stability criteria; and other related topics. First semester. Given in alternate years. Mr. Miller

E.E. 436. Power System Stability (3)

Continuation of E.E. 435. Transient stability problems, including machine inertias, governor action, unbalanced system conditions, various excitation systems and exciter transient effects, and switching operation. Second semester. Mr. Miller

E.E. 437. Advanced A.C. Machine Theory (3)

The two-reaction theory of synchronous machines in the steady and transient states; harmonic analysis; field and armature time constants; direct and quadrature synchronous, transient, and sub-transient reactances; electrical and mechanical transients of electrical machines, both singly and in conjunction with external circuits; calculation of voltage, current, mechanical oscillations, and hunting, forces and torques; operation of machines under unbalanced conditions and faults; effect of variable excitation. Two lectures and one laboratory period per week. First semester. Given in alternate years. Mr. Miller

E.E. 438. Advanced A.C. Machine Theory (3)

Continuation of E.E. 437. Second semester.

Mr. Miller

E.E. 441. Advanced Electronic Circuits (3)

Selected topics covering wide band amplifiers, pulse amplifiers, and other special amplifier circuits. Transient analysis of amplifiers. Television systems. Radar techniques. Servomechanisms. Microwave circuits. First semester. Mr. Mode

E.E. 442. Advanced Electronic Circuits (3)

Continuation of E.E. 441. Second semester.

Mr. Mode

E.E. 443. Advanced Theory of Networks (3)

Consideration of electrical networks from the general standpoint. Characteristics of two- and four-terminal networks; Foster's, Cauer's and Bartlett's theorems; transformation by matrix manipulation; theory of long-lines. First semester. Mr. Karakash

E.E. 444. Advanced Theory of Networks (3)

Continuation of E.E. 443. Advanced network theory. General approach to filter theory for lumped as well as distributed parameter systems. General field equations and applications to wave guides and cavities. Second semester.

Mr. Karakash

ENGLISH

Professors Severs, Christensen and Strauch

Associate Professors Riley and S. B. Ewing

Assistant Professors Rights, Armstrong, Everitt, Criswell, Dilworth and Hook

Messrs. Hertz, Hartung, Nead, Neville, Thompson, Bruns, Eisenberg, H. C. Miller, and Schug

FRESHMAN COMPOSITION

All students are required to complete successfully courses in freshman composition carrying a total of six credit hours toward graduation.

On the basis of their performance in preliminary tests given during freshman week, first semester freshmen are assigned to one of three courses designed to meet their particular needs. Engl. 1 is taken by all whose preparation appears to have been adequate but who do not give evidence of outstanding ability. Students who demonstrate superior ability and training take Engl. 11. Those who do poorly in the preliminary tests are required to take Engl. 0. Engl. 1 normally is followed by Engl. 2, and Engl. 11 by Engl. 12 in the second semester, while students who take and pass Engl. 0 in the first semester enroll in Engl. 1 in the second. A student whose classwork shows that he has been placed in the wrong group may be transferred to a higher or lower group at any time during the year, if his instructor recommends and the head of the department approves the transfer.

Since Engl. 0 carries no credit toward graduation, students assigned to this course in their first semester are required to continue the study of freshman composition beyond the freshman year until the minimum requirement of six semester hours has been met.

ENGLISH LITERATURE AND COMPOSITION

Students wishing to major in English literature should take as preliminary work either Engl. 4, 5, or 8, 9, or 11, 12, or such equivalent courses as may be recommended by the head of the department. They should then elect two English courses in each semester of the junior year and at least two in each semester of the senior year. Students working for honors take a seminar course in which they prepare a thesis as part of the honors requirement.

Engl. 0. Elementary Composition (0)

Drill in the fundamentals of English grammar and in the mechanics of writing. First and second semesters.

Engl. 1. Composition and Literature (3)

Practice in expository writing and the application of rhetorical principles; readings in expository prose; a rapid review of functional grammar. First and second semesters.

Engl. 2. Composition and Literature (3)

Continuation of Engl. 1. Further practice in expository writing in conjunction with readings in literature. *Prerequisite: Engl. 1.* First and second semesters.

Engl. 4. A Study of the Drama (3)

Reading and critical study of types of drama; theories of the drama; the drama and the stage; the drama as a criticism of life. *Prerequisite: Engl. 2.* First semester.

Engl. 5. A Study of the Drama (3)

Continuation of Engl. 4. *Prerequisite: Engl. 2.* Second semester.

Engl. 7. A Study of the Short Story (3)

A critical study of the short story, English, American, and Continental. Class discussions, extensive collateral reading, and reports. *Prerequisite: Engl. 2.* Second semester.

Engl. 8. English Literature (3)

A survey of English literature from *Beowulf* through the Pre-Romantics, with selected readings. *Prerequisite: Engl. 2.* First semester.

Engl. 9. English Literature (3)

A survey of English literature from Wordsworth to Housman. *Prerequisite: Engl. 2.* Second semester.

Engl. 11. Types of World Literature (3)

A course in composition and literature for superior students who do not need or who have had the basic training of English 1 and 2. In addition to wide and thoughtful reading in world masterpieces the course requires

correct and effective writing of critical essays, original sketches, and documented research papers. Not open to students who have taken Engl. 36. First semester.

Engl. 12. Types of World Literature (3)

Continuation of Engl. 11. *Same prerequisites as Engl. 11.* Second semester.

Engl. 18. The Novel (3)

A study of the types of the novel. Reading and reports; lectures on the history of the novel in England and America. *Prerequisite: Engl. 2.* First semester.

Engl. 19. The Novel (3)

Continuation of Engl. 18. *Prerequisite: Engl. 2.* Second semester.

Engl. 20. American Literature, 1607-1855 (3)

A survey of the major writers from the settlement of America to the Civil War. Lectures and class discussions. *Prerequisite: Engl. 2.* First semester.

Engl. 21. Modern American Literature (3)

A study of the development of American literature from Whitman to the present day. Lectures and class discussions. *Prerequisite: Engl. 2.* Second semester.

Engl. 35. Poetry (3)

The analytical and critical reading of poetry, to provide such acquaintance with idiom and technique that poetry may be read with pleasure and understanding. *Prerequisite: Engl. 2.* Second semester.

Engl. 36. Masterpieces of World Literature (3)

A study of great works selected from the literature of epic poetry, the drama, the romance, philosophy, and the essay to illustrate the humanistic traditions of Western civilization. Not open to students who have taken Engl. 11 or 12. *Prerequisite: Engl. 2.* First semester.

Engl. 41. Business Letters (3)

Rhetorical and psychological principles and forms in modern business communication; practice in writing letters of inquiry, request, reply, acknowledgment, adjustment, credit, collection, sales, and application. *Prerequisite: Engl. 2.* First and second semesters.

Engl. 117. The Modern Play and Playwright (3)

Readings and discussion of the foremost American dramas and dramatists. Summer session.

Engl. 142. Technical Writing (3)

Study and practice in forms and methods of technical exposition, de-

scription, definition, classification; the technical report, abstract. *Prerequisite: Engl. 2.* First and second semester.

Engl. 181. Undergraduate Thesis (3)

Open to advanced undergraduates who wish to submit theses in English. *Prerequisite: consent of head of department.* First semester.

Engl. 182. Undergraduate Thesis (3)

Continuation of Engl. 181. *Prerequisite: consent of head of department.* Second semester.

Engl. 183. Readings in English Literature (3)

Open to advanced students who wish to pursue special courses of reading in English literature. *Prerequisite: consent of head of department.* First semester.

Engl. 184. Readings in English Literature (3)

Continuation of Engl. 183. *Prerequisite: consent of head of department.* Second semester.

For Advanced Undergraduates and Graduates

Engl. 318. American Literature (3)

Movements that have shaped American thought and feeling as expressed in the national literature: Puritanism, Americanism, Romanticism, Transcendentalism, Individualism, the Civil War, Democracy, the West, Realism, Internationalism, and Skepticism, as presented by Jonathan Edwards, Franklin, Paine, Longfellow, Poe, Emerson, Thoreau, Mark Twain, Henry James, and Henry Adams. Summer session. Mr. Strauch

Engl. 320. The Novel (3)

The great masterpieces of prose fiction produced in England, in America, and on the Continent during the nineteenth and twentieth centuries. Development of types of the novel. The theory and technique of the novel. Summer session. Mr. Riley

Engl. 321. Contemporary Literature (3)

Present-day American literature. Collateral readings and reports. First semester. Mr. Strauch

Engl. 322. Contemporary Literature (3)

Present-day English and European literature. Collateral readings and reports. Second semester. Mr. Strauch

Engl. 323. Shakespeare and the Elizabethan Drama (3)

The development of the English drama, including the important plays of Shakespeare. First semester. Mr. Hook

Engl. 324. Shakespeare and the Elizabethan Drama (3)

Continuation of Engl. 323. Second semester.

Mr. Hook

Engl. 325. English Literature of the Romantic Era (3)

Poetry and prose of the chief romantic writers—Wordsworth, Coleridge, Scott, Byron, Shelley, Keats, Lamb, Hazlitt, DeQuincey—with consideration of the political, religious, and social problems of the period as they are exhibited in the literature. Readings and class discussions. First semester.

Mr. Severs

Engl. 326. English Literature of the Victorian Era (3)

Poetry and prose of the chief Victorian writers—Tennyson, Browning, Arnold, Clough, Rossetti, Morris, Swinburne, Macaulay, Carlyle, Mill, Newman, Ruskin—with consideration of the political, religious, and social problems of the period as they are exhibited in the literature. Readings and class discussions. Second semester.

Mr. Severs

Engl. 331. Milton (3)

The life and works of John Milton in connection with the history of his times and the chief sources of his inspiration. First or second semester.

Mr. Riley

Engl. 333. Restoration and Augustan Literature (3)

Prose and poetry from 1660 to 1745 with special emphasis upon the works of Dryden, Pope, and Swift, and some consideration of the influential ideas of Hobbes, Locke, Berkeley, and Hume. First or second semester.

Mr. Dilworth

Engl. 334. Age of Johnson (3)

English prose and poetry from 1745 to 1798—Dr. Johnson and his circle, and the Pre-Romantics, including Burns and Blake. First or second semester.

Mr. Dilworth

Engl. 335. History of the English Language (3)

A survey of the development of the English language, in vocabulary, pronunciation, and structure, beginning with its relation to the other Germanic languages and coming down to modern English usage. First or second semester.

Mr. Ewing

Engl. 336. Writing for Publication (3)

Comprehensive study of the short-story and practice in the various techniques of writing short-stories, essays, and poems with a view to publication. First or second semester.

Mr. Criswell

Engl. 337. The Renaissance (3)

The growth of English non-dramatic literature in the sixteenth century and the stimulus of the Italian Renaissance and northern humanism. Readings in and class discussions of the works of the chief writers—Petrarch, Erasmus, More, Wyatt, Surrey, Lyly, Sidney, and Spenser. First semester.

Mr. Ewing

Engl. 338. The Seventeenth Century (3)

The rich variety of English literature from Donne to Dryden—Donne and the "Metaphysical School"; Jonson and "The Tribe of Ben"; Cavalier and religious poetry; the prose of Bacon, Browne, Burton, Walton, and Bunyan. Second semester.

Messrs. Armstrong, Christensen

For Graduates

Candidates for the master's degree majoring in English literature may qualify for the degree under either of two plans offered by the department. Under Plan I the candidate is required to complete successfully eight semester courses (twenty-four hours), and to write a thesis representing the equivalent of six hours of course work, but he is not required to take an examination covering the entire field. Under Plan II no thesis is required; but the student, in addition to completing successfully ten semester courses (thirty semester hours), must pass an examination, usually oral, covering the entire field of English literature. The candidate selects the plan better suited to his needs and abilities, upon the advice and with the approval of the head of the department.

If his needs and interests make it desirable for him to do so, the candidate for the master's degree is permitted to take collateral work in other departments to the extent of six semester hours in lieu of an equivalent amount in the major field.

Candidates for the doctor's degree are expected to master the subject matter of the entire field of English and American literature. Other requirements for the doctorate will be found on pages 139 to 142.

Students desiring to qualify for graduate degrees in this department should have taken as part of their undergraduate work at least twelve semester hours of advanced courses in English literature. Those with undergraduate deficiencies who are admitted because otherwise well qualified will be expected to make up such deficiencies in addition to satisfying the minimum requirements for the degree sought.

Engl. 420. Graduate Seminar (3)

An intensive study of the works of an English author or a type of literature. Summer session.

Messrs. Armstrong, Dilworth, Ewing, Hook, Riley, Severs, Strauch

Engl. 421. Graduate Seminar (3)

An intensive study of the works of one or more English or American authors. Subject and instructor vary from semester to semester according to the needs of the students and the wishes of the Department. Courses which have been given and are available are Donne (Mr. Armstrong), Pope (Mr. Dilworth), Johnson's Literary Criticism (Mr. Dilworth), Spenser (Mr. Ewing), Shakespeare's History Plays (Mr. Hook), Epic Poetry (Mr. Riley), Keats (Mr. Severs), Wordsworth (Mr. Severs), Emerson and Hawthorne (Mr. Strauch), Whitman and Melville (Mr. Strauch). First semester.

Messrs. Armstrong, Dilworth, Ewing, Hook, Riley, Severs, Strauch

Engl. 422. Graduate Seminar (3)

Continuation of Engl. 421. Second semester.

Messrs. Armstrong, Dilworth, Ewing, Hook, Riley, Severs, Strauch

Engl. 427. Old English (3)

A study of the Old English language and literature. First or second semester. Mr. Riley

Engl. 429. Literary Criticism (3)

A course aimed to correlate and unify the student's previous work in literature by means of wide readings in critical literature and discussions of theories and schools of criticism. First semester. Mr. Ewing

Engl. 430. Literary Criticism (3)

Continuation of Engl. 429. Second semester. Mr. Ewing

Engl. 431. Graduate Thesis (3)

First semester. Mr. Severs

Engl. 432. Graduate Thesis (3)

Second semester. Mr. Severs

Engl. 433. Literature of the Fourteenth Century (3)

Types of medieval literature with special attention to Langland, Gower, Chaucer. (*Not offered 1955-56*). Mr. Severs

Engl. 434. Chaucer (3)

A study of the life and works of Chaucer, with some attention to his chief contemporaries. Readings, reports, and class discussions. First semester. Mr. Severs

Engl. 435. Chaucer (3)

Continuation of Engl. 434. *Prerequisite: Engl. 434*. Second semester.

Mr. Severs

Engl. 436. Bibliography and Methods of Research (3)

A study of the bibliographical tools essential to an advanced student of English literature. Survey of historical, or critical, bibliography, of both

printed books and manuscripts; of practical bibliography, including direction in the compilation of a list of books and articles on an assigned subject and in the procedures of thesis writing; and of enumerative bibliography, including an introduction to the chief printed bibliographies of the English language and literature. First or second semester. Mr. Severs

SPEECH — RADIO — THEATRE

Professor H. B. Davis

Assistant Professor Rights

Messrs. Barker, Prichard and Woods

Speech Clinic

For the purpose of diagnosis and treatment of speech defects. Individual instruction provided for students with minor disturbances of voice and speech, as well as those with more serious handicaps. Open to all students in need of corrective treatment and to those desiring speech tests. By appointment. No credit.

Speech 30. Fundamentals of Speech (3)

A foundation course designed to develop knowledge of the basic principles of speech and ability to speak effectively on the platform. First and second semesters.

Speech 31. Business and Professional Speaking (3)

Development of speech for business and professional problems: technique of expository speaking; use of visual graphics; persuasive speaking applied to the emotional or analytical approach in selling; methods of interviewing; techniques of conference. *Prerequisite: Speech 30.* First and second semesters.

Speech 32. Discussion and Argument (3)

The technique of investigation, analysis, evidence, inference, briefmaking, and refutation in oral argument; participation in the various forms of discussion—conference table, panel, and symposium—and in various types of debate—conventional, cross-examination, and direct clash. *Prerequisite: Speech 30.* First and second semesters.

Speech 33. Parliamentary Procedure (1)

Study and drill in modern rules and methods of conducting organized group-deliberation. First and second semesters.

Speech 34. Debate (1)

A study of the principles and techniques of debate, analysis, evidence, reasoning, refutation, briefing, speech composition and delivery skills. Members required to participate in the activities of the Debate Society. First and second semesters.

Speech 51. Radio Workshop (3)

A practical course in the organization and production of radio and television programs, development of radio voice, and radio techniques, with emphasis on the use of radio in the fields of journalism, advertising, business, and dramatics; practical experience over local radio station. First and second semesters.

Speech 52. Radio Workshop (3)

Continuation of Speech 51. *Prerequisite: Speech 51.* Second semester.

Speech 61. Dramatics (3)

The practical technique and production of plays; acting, stage-lighting, scenic design and execution, and student direction of plays. Each member must write either an original one-act play or a thesis upon any practical problems of the modern theatre. One play is presented each semester.

Speech 62. Dramatics (3)

Continuation of Speech 61. *Prerequisite: Speech 61.*

For Advanced Undergraduates and Graduates

Speech 251. Radio Workshop (3)

A practical course in the organization and production of radio programs, development of radio voice, and radio techniques. Particular attention will be given to the difficulties encountered by those who teach radio or have to produce school programs. Practical experience over local radio station. Summer session.

Mr. Davis

Speech 260. Speech for the Teacher (3)

An orientation course in the field of speech for those engaged in classroom teaching or in directing extra-curricular speech activities. Discussion as a teaching device; integration of speech with other subjects; recognition of common defects of speech; modern emphases in speech contest; individual investigations, report, and conferences. Summer session

Mr. Davis

Speech 261. Dramatics (3)

A practical course in the production of plays; problems of designing of scenic effects, directing, and acting. Particular attention will be given to the difficulties encountered by those who teach dramatics. A production will be given by the class. Summer session.

Mr. Davis

JOURNALISM

Assistant Professor McFadden

Messrs. Hutchins, Breth

Students majoring in journalism may elect in their sophomore year one of five sequences leading toward professional training in

the following areas of communications: (1) newspaper practice; (2) government information; (3) communications in industry; (4) management of natural resources; (5) business and technical publications. The differentiation is largely on the basis of the nature of the collateral courses taken.

All majors must complete at least four credits in Journ. 1-8, Brown and White, taking it each semester after declaring their major. They must also take Journ. 11, 12, 13, 15, 16, 17, 118, and 120. A minimum of thirty credits, including Brown and White, is required for graduation.

Journ. 1-8. Brown and White (1)

Enrollment constitutes membership on the staff of the semi-weekly paper. The student elects either editorial or business subdivision, and wins promotion on a merit system. Students enrolling for their first semester register for Journ. 1; for their second semester, Journ. 2; etc. By faculty action this course may be elected each semester for credit in addition to other courses on a student's roster. First and second semesters.

Journ. 11. Newspaper Reporting and Writing (3)

Definition, determinants, and components of news; the lead; news structure and style; sources; interviewing; practice in gathering and writing news about speeches, sports, special features; the readability formula. *Prerequisite: Engl. 2.* First semester.

Journ. 12. Advanced Newspaper Reporting and Writing (3)

Reporting and writing of public affairs, including news of government on the local, county, state, and federal levels; civil and criminal courts; labor, science, and entertainment news. *Prerequisite: Journ. 11.* Second semester.

Journ. 13. Newspaper Editing and Copy Reading (3)

Study and practice of newspaper desk work; headline writing, makeup, and typography; selecting, editing and rewriting news and feature copy; use of reference works and morgue. *Prerequisite: Journ. 11.* First semester.

Journ. 14. Press Photography (3)

A study of the fundamentals of news and feature photography; practice in planning and taking pictures, in developing pictures, and in making suitable enlargements for publication; lecture-demonstrations and laboratory assignments in the use of cameras, lights, filters, special lenses, and enlargers. Second semester.

Journ. 15. Editorial Writing (3)

Editorial interpretation of current events; practice in interpretative writing, including editorials, side and follow-up features, the news review,

column, newsletter, magazine article, departmentalization. *Prerequisite: Journ. 11.* Second semester.

Journ. 16. Law of the Press (3)

Libel, privacy, rights and privileges of the press, ethics, postal regulations, copyright, and crusades; dealing with pressure groups. Second semester.

Journ. 17. Magazine Article Writing (3)

Writing and marketing magazine non-fiction articles from short filler items to full length features as dictated by current market needs; article types; manuscript preparation; illustrating; mailing; market analysis; slanting; editorial contacts, taboos. First semester.

Journ. 21. Creative Writing (3)

The study and writing of essays and short-stories (and verse, if requested), with a view to developing each student's particular talent. *Prerequisite: Engl. 2.* First semester.

Journ. 22. Creative Writing (3)

Continuation of Journ. 21. *Prerequisite: Engl. 2.* Second semester.

Journ. 31. Community Journalism (3)

An elective for students interested in the small-town weekly field. A study of ethical and legal problems, community news sources, business and promotional problems. Careful examination of community papers which lead in local news coverage, classified advertising, photography, circulation, community service, and local advertising. Laboratory work on community newspapers in this region. First semester.

Journ. 32. Community Journalism (3)

Continuation of Journ. 31. Second semester.

Journ. 43. Communications in Industry (3)

Study of the problems of human relations and communications in business and industry; theory and practice of management communications with employees, customers, stockholders and the community, with emphasis on methods and techniques currently being used to develop improved human relations. *Prerequisites: Engl. 2, and consent of head of department.* First and second semesters.

Journ. 118. History of American Journalism (3)

English background of the American newspaper; development of press from Colonial days to the present; influence of newspaper on American life; contributions of outstanding journalists. Second semester.

Journ. 120. Journalism Proseminar (3)

Required of students of senior standing who are majoring in journalism. Survey of the newspaper field in its relation to public affairs. Extensive reading in books, magazines, and newspapers. First semester.

Journ. 123. Editing the House Organ and Trade Publication (1)

A course in selecting copy, in planning layouts, and in handling elementary problems of editing trade magazines. *Prerequisite: Engl. 2.* First semester.

For Advanced Undergraduates and Graduates

Journ. 201. Modern Newspaper Practice (3)

A course in methods of securing, writing, and editing news. Evaluation and organization of news; study of news sources and values and reader interest; difficulties encountered by faculty advisers of secondary school publications; individual conferences with such advisers. Summer session.

Mr. McFadden

FINANCE

Professors Bradford and Jensen

Assistant Professor Schwartz

Mr. Krouse

Fin. 125. Principles of Corporation Finance (3)

An intensive course covering the fundamentals of corporation finance in one semester. *Prerequisite: Eco. 3.* First and second semesters.

Fin. 126. Problems in Corporation Finance (3)

Continuation of Fin. 125. *Prerequisite: Fin. 125.*

Fin. 129. Money and Banking (3)

A general course dealing with the nature and functions of money and commercial banking, monetary and banking development in the United States, the banking process, banking problems, the value of money, international exchange, and monetary and credit policies. *Prerequisite: Eco. 4.* First semester.

Fin. 130. Money and Banking (3)

Continuation of Fin. 129. *Prerequisite: Fin. 129.* Second semester.

Fin. 133. Money and Banking (3)

The nature of money and commercial banking, the banking process in the United States, current banking problems, the value of money, and credit policy. *Prerequisite: Eco. 4.* First and second semesters.

Fin. 153. Credits and Collections (3)

A course devoted to the part played by consumer and mercantile credit in modern business, with emphasis upon the place of these types of credit

in the economy, credit instruments, sources of credit information, analysis and evaluation of the credit risks, collection methods and procedures, and technical and legal aspects. *Prerequisites: Acctg. 2 or 104; Eco. 4.* First semester.

Fin. 232. Monetary-Fiscal Policy (3)

A course devoted to the study of monetary, credit and fiscal policies of governments and central banks with particular reference to policies of the United States Treasury and the Federal Reserve System. Current problems will receive special emphasis. *Prerequisites: Fin. 130 or 133.* First semester. Mr. Bradford

Fin. 241. International Trade and Finance (3)

Economics, commercial, and financial relations of nations, including economic organizations, basic principles and practices of international trade, finance, and investment. *Prerequisites: Fin. 130 or 133 or graduate standing and consent of head of department.* First semester. Mr. Jensen

For Advanced Undergraduates and Graduates

Fin. 323. Investments (3)

A study, from the standpoint of the investor, of the various types of corporation and government securities, with special reference to owners' equities, comparative yields, and the machinery of investment, including stock exchange operations. *Prerequisite: Fin. 125.* First semester. Mr. Schwartz

Fin. 324. Investments (3)

A project course in investment analysis for advanced students who are already familiar with investment principles. Sources of data and analysis procedures; the securities of industrials, railroads, public utilities, and municipalities. *Prerequisite: Fin. 323.* Second semester. Mr. Schwartz

Fin. 331. Bank Credit Problems (3)

A course dealing with the problems surrounding the extension of loans to customers and the purchase of open market paper by the individual banker. Legal regulations and restrictions, the instruments of bank credit extension, and the analysis of the bank borrower's credit position will be treated in detail. *Prerequisite: Fin. 130 or 133.* Second semester. Mr. Bradford

Fin. 342. International Trade and Finance (3)

Continuation of Fin. 241. *Prerequisites: Fin. 241, or Fin. 130, or Fin. 133 and consent of instructor.* Second semester. Mr. Jensen

Fin. 351. Public Finance: Federal (3)

A course dealing with government expenditures and revenues, the economics of taxation, and government administration. *Prerequisite: Eco. 4.* First semester. Mr. Krouse

Fin. 352. Public Finance: State and Local (3)

The major issues regarding revenues, expenditures, debt and budgeting policy will be examined in the light of fiscal principles and economic effects. Particular attention will be given to current practices in Pennsylvania and contiguous states. *Prerequisite: Fin. 351.* Second semester. (*Not offered 1954-1955.*)

Fin. 371. Readings in Finance (3)

A course of readings in various fields of finance, designed for the student who has a special interest in some field of finance not covered by the regularly rostered courses. *Prerequisite: Consent of head of department.* First semester. Mr. Bradford

Fin. 372. Readings in Finance (3)

Continuation of Fin. 371. *Prerequisite: Consent of head of department.* Second semester. Mr. Bradford

For graduate program see Business Administration

FINE ARTS

Professor Quirk

Assistant Professor Schuchard

F.A. 3. History of Architecture (3)

The development of architecture from Egypt and Mesopotamia, through Greece and Rome, the early Christian and Romanesque periods to the rise of Gothic. First semester.

F.A. 4. History of Architecture (3)

Continuation of F.A. 3. The spread of Gothic architecture, the incoming of the Renaissance, followed by discussions of succeeding styles, classicism, romanticism, functionalism, the international style, and contemporary movements. Second semester.

F.A. 5. Freehand Drawing (3)

Elementary freehand drawing from nature, portrait models, still life, and casts with practice in various media. Beginners and trained students. Evaluation based on individual advancement. First semester.

F.A. 6. Freehand Drawing (3)

Further practice in techniques; color theory with painting in chosen media. Second semester. Beginners and trained students. Emphasis on contemporary expression, development of basics.

F.A. 7. Advanced Drawing and Painting (3)

A continuation of the work in F.A. 5 and 6. *Prerequisites: F.A. 5 or 6; consent of head of department.* Advanced students only. First semester.

F.A. 8. Advanced Drawing and Painting (3)

A continuation of the work in F.A. 5 and 6. *Prerequisites: F.A. 5 or 6; consent of head of department.* Advanced students only. Second semester.

F.A. 11. Ancient and Medieval Art (3)

An approach to the understanding and enjoyment of the arts; development of art through the ancient and medieval periods; relations between artistic expression and the age which produced it. Lectures. Open to all classes. First semester.

F.A. 12. The Art of the Italian Renaissance (3)

Painting, sculpture, and architecture are examined as the outgrowth of conditions in Italy during the fourteenth, fifteenth, and sixteenth centuries: the influence of medieval thought and tradition, the awakening interest in nature, the effect of antiquity, especially the stimulus it gave to individual effort. Lectures. Open to all classes. Second semester.

F.A. 13. The Art of the Northern Renaissance (3)

Art in Europe other than Italy from the fifteenth century to the French revolution; contrasts between native tendencies and foreign influences, especially those of the Italian renaissance, with the resulting struggle between idealism and realism. Lectures. First semester.

F.A. 14. Modern Art (3)

The nineteenth and twentieth centuries; historical relationships, underlying theories, and influence of contemporary thought as aids in understanding modern art. The discussions include classicism, romanticism, impressionism, and the various modern schools. Second semester.

F.A. 17. Criticism and Analysis of Art (3)

A critical analysis of the divergent views of the nature of art, its origin and intention. The ancient writers are consulted for views held in Greece and Rome. Factors in molding art opinion in the middle ages; changes in the renaissance. Primarily for majors, *Prerequisites: F.A. 11 and 12, or suitable preparation in the history of fine arts; and consent of head of department.* First semester.

F.A. 18. Criticism and Analysis of Art (3)

Continuation of F.A. 18 with special attention to art criticism since the 17th century. *Prerequisite: same as for F.A. 17.* Second semester.

Art Galleries

The Lehigh Art Gallery, located on the second floor of the University Library, is the scene of teas and receptions for the exhibiting artists at the Sunday afternoon openings which occur

once a month. Drawings, paintings, sculpture and prints by contemporary American and Foreign artists, are continually on display. The exhibitions, intended for campus family and community, are open to the public Sundays, Tuesdays, Wednesdays, and Thursdays from 2:00 to 5:00 P.M.

The Memorial Portrait Gallery containing a number of portraits presented by alumni and friends, in honor of the sitters, and located in the South Wing of the Alumni Memorial Building, is open to the public during the regular University hours as is also The Gallery of American Art, which occupies the North Wing of the same building. This collection changes as new items are acquired, by gift or through the Art Department Purchase Fund.

These Galleries offer definite evidence of the University's educational and cultural program, and docent service may be obtained for groups of ten or more as a Department of Fine Arts Service to the public.

F.A. 25. Principles and Practices of Painting

The principles and techniques of painting. The greater portion of the time is devoted to actual painting from nature and portrait models. Occasional lectures, illustrated by lantern slides and color reproductions, on composition, techniques, color, light, plastics, special effects, and mood. Primarily for students in the Adult Education Program. *Prerequisite: F.A. 5 or 6, or consent of the instructor.* Classes held Wednesdays, 7-10 P.M. No credit given.

F.A. 26. Creative Painting

The course aims to develop the imaginative and creative powers of the student. Special attention is given to problems of composition. Primarily intended for Adult Education. *Prerequisite: F.A. 5 or 6, or consent of instructor.* Class held Wednesdays, 7-10 P.M.

FRENCH

See Romance Languages

GEOLOGY

Professors Willard and Gault

Associate Professor Whitcomb

Assistant Professors G. R. Jenkins and J. D. Ryan

Messrs. Lamb, McCallum, Virgin and Weiler

Geol. 1. Principles of Geology (3)

An introductory survey of geologic processes. Lectures: laboratory exercises on common minerals, rocks, ores, and fossils; study of topographic maps. First semester.

Geol. 3. Fundamentals of Geology (3)

A basic study of earth materials and geologic processes. Emphasis on the development of the land forms; work on minerals, rocks and topographic maps. Lectures, laboratory. First semester.

Geol. 4. Fundamentals of Geology (3)

Continuation of Geology 3. Elementary meteorology and economic geology. An interpretation of geology as it affects the average citizen. Lectures, laboratory and field trips. *Prerequisite: Geol. 3 or consent of instructor.* Second semester.

Geol. 6. Engineering Geology (4)

Designed primarily for students in Civil Engineering. Basic geologic principles; selected minerals, rocks, building materials, geologic structures; applications of geology to such problems as dam sites, tunnels, foundations, highways, underground water, and flood control. Three lectures and one laboratory period or field trip per week. Second semester.

Geol. 12. Historical Geology (3)

The development of the continents and life forms; evolution based on the remains of animal and plant life preserved in the rocks. Lectures, laboratory, and field trips. *Prerequisites: Geol. 1, or 3 and 4, or 6. Geol. 4 may be taken concurrently.* Second semester.

Geol. 31. Mineralogy (3)

The principles of crystallography, with practice in determination of forms of models and crystals; the physical properties, origin, occurrence, association, and alteration of minerals; a study of common mineral species and varieties, with practice in identification based on physical properties. *Prerequisite: Chem. 4 or its equivalent.* First semester.

Geol. 32. Petrology (3)

Introduction to the origin and classification of rocks. Megascopic study and identification of common rock-forming minerals and rocks in the laboratory. Lectures and laboratory. *Prerequisite: Geol. 31.* Second semester.

Geol. 42. Geologic Surveying (1)

Field and laboratory practice in methods of geologic mapping and measurement. Use of plane table and alidade, Brunton compass, aneroid barometer, hand level, topographic maps and aerial photos. *Prerequisites: Geol. 12, Math. 1, and C.E. 40, or their equivalents.* Second semester.

Geol. 43. Cartography (1)

The making and interpretation of maps; photogrammetry and the use of the stereoscope. Field and laboratory. *Prerequisites: Geol. 12, geology or conservation major.* First semester.

Geol. 141. Field Geology (3)

Practice in mapping and field work. Each student is assigned a field problem and is required to prepare a report thereon with geologic map, structure section, and collection of a full set of specimens. *Prerequisites: Geol. 223, 312.* First semester. Mr. Willard

Geol. 146. Field Problems (3)

Essentially the same in purpose as Geol. 141, though of different content, this course may be taken separately or as a continuation of Geol. 141. *Prerequisites: Geol. 312, 223 previously or concurrently.* Second semester. Mr. Willard

Geol. 181. Geological Problems (1-4)

Special problems in field, laboratory, and library. Specific work is assigned in individual cases. *Prerequisite: Consent of head of department.* Prospective students for this course should consult the department head. First semester. Messrs. Gault, Jenkins, Ryan, Whitcomb, Willard

Geol. 182. Geological Problems (1-4)

Similar to Geol. 181. Geol. 182 may be elected as a continuation of Geol. 181 or separately. *Prerequisites as for Geol. 181.* Prospective students should consult department head. Second semester. Messrs. Gault, Jenkins, Ryan, Whitcomb, Willard

For Advanced Undergraduates and Graduates

Geol. 223. Structural Geology (3)

The major and minor structures encountered in both the massive and the layered rocks of the earth's crust. Problems of the type encountered in geological, geophysical, and mining work are studied in the laboratory and field. *Prerequisites: Geol. 12; Geol. 32 previously or concurrently.* Second semester. Mr. Ryan

Geol. 255. Mineral Resources (3)

Discussion of world mineral deposits, their distribution, occurrence and origin. Includes fuel, non-metal and metal deposits. Lectures, laboratory and visits to operating deposits. *Prerequisites: Geol. 12, 32.* First semester. Mr. Gault

Geol. 256. Mineral Resources (3)

A continuation of Geol. 255. *Prerequisite: Geol. 255.* Second semester. Mr. Gault

Geol. 311. Paleontology (3)

Plant and invertebrate fossils from the morphologic point of view; their

use in interpreting geologic history; evolution of the faunas and floras. Lectures and laboratory work. *Prerequisites: Geol. 12 or Biol. 1, or 31, and 32.* First semester. Mr. Whitcomb

Geol. 312. Stratigraphy (3)

The origin, history, sequence, and correlation of bedded rocks; their fossils, ages, distribution, and structures. Lectures, laboratory, and field trips. *Prerequisite: Geol. 12, 32.* Second semester. Mr. Willard

Geol. 331. Optical Crystallography (3)

The polarizing microscope and its application in the examination and identification of minerals by the immersion method and in thin section. *Prerequisites: Geol. 12, 32.* First semester. Mr. Ryan

Geol. 332. Petrography (3)

Microscopic studies of igneous, sedimentary, and metamorphic rocks in thin section. *Prerequisite: Geol. 331.* Second semester. Mr. Ryan

Geol. 333. Descriptive Mineralogy (1-2)

The important rock forming mineral families, their chemical properties, equilibrium relations, isomorphism and polymorphism. Examination of selected collections. Lectures, laboratory and reports. *Prerequisite: Geol. 331, previously or concurrently.* Offered as required. First semester.

Messrs. Gault and Ryan

Geol. 334. Descriptive Mineralogy (1-2)

Continuation of Geol. 333. *Prerequisite: Geol. 333.* Offered as required. Second semester. Messrs. Gault and Ryan

Geol. 342. Field Trip (1)

The spring field trip, of several days' duration, is held after mid-semester. The first part of the semester is devoted to literature, reports, and discussions germane to the announced trip. A written summary of the excursion is required of each participant. *Prerequisite: Consent of head of department.* Second semester, alternate years. (*Offered 1956-57.*)

Geol. 344. Field Trip (1)

Similar to Geol. 342, but arranged to visit a different region. *Prerequisite: Consent of head of department.* Second semester, alternate years. (*Offered 1957-58.*)

Geol. 361. Water Resources (3)

Occurrence and management of water resources; the hydrologic cycle; survey of water resources and problems; hydrometeorology; disposition of precipitated moisture by runoff, infiltration, and evapotranspiration; occurrence and utilization of ground water resources. Lectures, laboratory and field trips. *Prerequisite: consent of head of department.* First semester.

Mr. Jenkins

Geol. 362. Soil Resources (3)

Fundamentals of soil science: physical, chemical, and organic constituents of soils; soil morphology and classification; soil moisture; plant nutrition. Land classification and problems of land utilization. Lectures, laboratory and field trips. *Prerequisite: consent of head of department.* Second semester. Mr. Jenkins

Geol. 371. Meteorology (3)

Principles of meteorology, composition of the atmosphere, physics of the air, weather phenomena, air masses and fronts, wind systems, cyclones and anticyclones. weather instruments and forecasting. First semester.

Mr. Jenkins

Geol. 372. Climatology (3)

Climatologic observations, climatic statistics and problems, world climate types; application of climatology to man's needs and activities. Second semester. *Prerequisite: Geol. 371 or its equivalent.*

Mr. Jenkins

For Graduates

Geol. 402. Advanced Physiography (3)

Detailed study of physiographic types and processes. Conferences and reports, with work in the laboratory and field. Second semester. (*Offered 1957-58.*)

Mr. Whitcomb

Geol. 411. Advanced Paleontology (3)

Detailed study of selected groups of fossils: generic and specific differences, identifications, descriptions; preparation of fossils; paleoecology. First semester.

Messrs. Whitcomb, Willard

Geol. 412. North American Index Fossils (2)

Study of a limited series of representative North American index fossils, their distinguishing characters, geographic distributions, geologic ranges. Laboratory work supplemented by field excursions to demonstrate stratigraphic paleontology. Second semester. (*Offered as required.*)

Mr. Willard

Geol. 413. Applied Stratigraphy (3)

Stratigraphic problems, laboratory preparation of collected material, megascopic and microscopic studies of sediments. First semester. (*Offered 1957-58.*)

Messrs. Gault, Ryan, Willard

Geol. 414. History of Geology (2)

The growth of geology and geologic thought from the Greeks to the present; the great geologists, their theories, controversies and contributions. Reading, conferences, preparation of reports. Second semester.

Mr. Whitcomb

Geol. 416. Vertebrate Paleontology (3)

The origin and evolution of the several classes of vertebrate animals

based upon paleontology and comparative osteology. Lectures and laboratory supplemented by museum trips. Admission with the permission of the instructor. (Offered as required.) Mr. Willard

Geol. 421. Tectonics (3)

The principles of structural geology; nature and origin of minor structures in crystalline and sedimentary rocks; petrofabrics. Conferences, assigned reading, laboratory and field work. First semester. (*Offered 1957-58.*) Mr. Ryan

Geol. 432. Advanced Petrology (3)

Problems in the petrogenesis of crystalline rocks. Particular attention is directed toward the correlation of field, chemical and petrographic data. Lectures, laboratory and occasional field trips. Second semester. (Offered as required.) Mr. Ryan

Geol. 434. Physical Crystallography (2)

An advanced course in the geometrical and physical properties of crystals, with special reference to the Goldschmidt method of crystal measurement and projection. Second semester. (Offered as required.) Mr. Ryan

Geol. 435. Advanced Mineralogy (1-3)

A survey of the more advanced methods of mineral study such as differential thermal analysis, radiography, x-ray, and chemical methods and the application of one to an original problem. (Offered as required.) First semester. Messrs. Gault and Ryan

Geol. 436. Advanced Mineralogy (1-3)

Similar to Geology 435. May be elected as a continuation of Geol. 435 or separately. Second semester. (Offered as required.) Messrs. Gault and Ryan

Geol. 441. Geology of Pennsylvania (3-6)

The geology of Pennsylvania and certain other portions of the east-central United States. The stratigraphic sequence embraces the pre-Cambrian, the entire Paleozoic, most of the Mesozoic and Tertiary, the Pleistocene, and recent deposits. Structures are chiefly those of the northern Appalachians. Conferences, reading assignments, preparation of reports, and field trips. First or second semester. May also be arranged to run throughout the year. (Offered as required.) Mr. Willard

Geol. 451. Principles of Mineral Deposits (3)

Advanced study of mineral deposits including historical development of present-day concepts, theories of origin, and principles of classification. Discussion of structure, alteration, mineralogy, and occurrence of types of metallic and non-metallic deposits throughout the world. Microscope study of ore minerals and textures. First semester. (*Offered in 1956-57.*) Mr. Gault

Geol. 452. Principles of Mineral Deposits (3)

Continuation of Geol. 451. Second semester. (*Offered in 1956-57.*)

Mr. Gault

Geol. 453. Mineral Deposits of North America (3)

Description and discussions of origin of the metallic and non-metallic mineral deposits of North America and comparison with similar types throughout the world. Laboratory study of suites from important deposits including microscope examination of ores and rock slices. First semester. (*Offered in 1955-56.*)

Mr. Gault

Geol. 454. Mineral Deposits of North America (3)

Continuation of Geol. 453. Second semester. (*Offered in 1955-56.*)

Mr. Gault

Geol. 481. Geological Investigation (1-6)

The investigation of special problems. Field, laboratory, library work on some limited area; presentation of a report thereon. Geol. 481 may be elected separately from Geol. 482. First semester.

Messrs. Gault, Jenkins, Ryan, Whitcomb, Willard

Geol. 482. Geological Investigation (1-6)

Similar to Geol. 481. May be elected as a continuation of Geol. 481 or separately.

Messrs. Gault, Jenkins, Ryan, Whitcomb, Willard

GERMAN

Professor More

Associate Professor Tremper

Assistant Professor Lazenby

Mr. Weisstein

First semester freshmen who have studied German in secondary school and who plan to continue the language in college will take a placement test during freshman week. The results in the test will be taken into consideration in assigning them to the proper initial course in college.

Ger. 1. Elementary German (3)

Drill in the fundamentals of German grammar; pronunciation; simple conversation and composition; extensive outside reading of simple vocabulary-building texts. No previous study of German required. First and second semesters.

Ger. 2. Elementary German (3)

Continuation of Ger. 1. *Prerequisite:* Ger. 1. First and second semesters.

Ger. 3. Intermediate German (3)

German prose and poetry; outside reading; composition. *Prerequisite:* one year of college German or two units of entrance German. First and second semesters.

Ger. 4. Intermediate German (3)

Continuation of Ger. 3. *Prerequisite: Ger. 3.* Second semester.

Ger. 7. Scientific German (3)

Reading of selected texts in the German of science, with particular emphasis on chemistry and physics. Recitations and individual conferences. *Prerequisite: one year of college German or three units of entrance German.* First or second semester.

Ger. 9. Advanced German, Prose and Poetry (3)

Rapid reading of representative texts; collateral reading. *Prerequisite: two years of college German or three units of entrance German.* First semester.

Ger. 10. Goethe's Faust (3)

Study of Part I; lectures on the origin and development of the Faust story; collateral reading. *Prerequisite: Ger. 9 or high standing in Ger. 3, 4, or 7.* Second semester.

Ger. 13. Lessing, Goethe, and Schiller (3)

Prerequisite: Ger. 10. First semester.

Ger. 14. Lessing, Goethe, and Schiller (3)

Continuation of Ger. 13. *Prerequisite: Ger. 10.* Second semester.

Ger. 22. Conversation and Composition (3)

Review of German grammar; composition and conversation of a more advanced type. *Prerequisite: Ger. 10 or high standing in Ger. 3, 4, or 7.* First or second semester.

For Advanced Undergraduates and Graduates

Ger. 211. Nineteenth Century German Drama (3)

Lectures, reading, reports on assigned work. *Prerequisite: Ger. 10.* First semester.
Messrs. More, Tremper

Ger. 212. Nineteenth Century German Drama (3)

Continuation of Ger. 211. *Prerequisite: Ger. 10.* Second semester.
Messrs. More, Tremper

Ger. 215. The German Short Story (3)

Origin and development. Rapid reading of illustrative stories, with particular attention to Gottfried Keller. Theodor Storm, C. F. Meyer, and Paul Heyse; lectures and reports. *Prerequisite: Ger. 10.* First semester.

Mr. Lazenby

Ger. 216. The German Short Story (3)

Continuation of Ger. 215. *Prerequisite: Ger. 10.* Second semester.

Mr. Lazenby

GOVERNMENT

See History and Government

HISTORY AND GOVERNMENT

Professors Harmon, Schulz, and Aiken

Associate Professors Kyte, Cowherd, and Tresolini

Assistant Professor Haight

Messrs. L. C. Taylor, E. R. Baldrige, Jr., and J. E. Davies

HISTORY

Hist. 11. Development of Western Civilization (3)

The roots of Western civilization; the evolution of economic, social, and political institutions; the impact of scientific and technological developments; the influence of major trends of thought. Required of all freshman engineering students. First semester.

Hist. 12. Development of Western Civilization (3)

The modern Western world; the rise of the nation-state; the occident and the orient; the rise and decay of the older imperialisms; the role of science and idealism in both peace and war in the twentieth century. Required of all freshman engineering students. Second semester.

Hist. 13. United States History (3)

The era of constitution-making; the evolution of political parties; foreign relations during the wars of the French revolutionary period; the western movement and western state-building; the growth of sectionalism. First semester.

Hist. 14. United States History (3)

The war for the Union; the reconstruction of the South; the era of big industry and labor combinations; the United States as a world power; the new national paternalism. Second semester.

Hist. 25. European History (3)

A rapid survey of the major historic forces from the collapse of the Roman Empire to the sixteenth century; the cultural aspects of medieval society. First semester.

Hist. 26. European History (3)

Continuation of Hist. 25. A survey of historic developments from the sixteenth to the nineteenth centuries. Second semester.

Hist. 27. European Expansion and Empire Building (3)

A study of the impact of European ideas and actions upon the peoples of India and Southeast Asia. First semester.

Hist. 28. European Expansion and Empire Building (3)

A study of the impact of European ideas and actions upon the peoples of China and Japan. Second semester.

Hist. 29. Modern Europe (3)

The study of revolution and reaction in western Europe between 1789 and 1870. Emphasis is laid upon the birth, growth, and spread of nineteenth-century liberal doctrines as well as upon the attempts made to stifle that growth by every political and diplomatic means available. First semester.

Hist. 30. Modern Europe (3)

A study of contemporary Europe; the origins and consequences of two World Wars; the rise of revolutionary governments in Italy, Germany, and Russia. Second semester.

Attention is called also to the following courses in history offered by other departments: Eco. 1, Industrial Evolution; Gk. 21, Ancient History; Lat. 22, Ancient History; Gk. 183, The Economic and Social Life of the Greeks; Lat. 184, The Economic and Social Life of the Romans.

For Advanced Undergraduates and Graduates

Hist. 251. A Proseminar in United States and Pennsylvania History for Teachers (3)

This course is designed to meet the certification requirements of the Pennsylvania State Council of Education, that all teachers in the public schools should have a course in United States history in which particular emphasis is placed upon the history of Pennsylvania. The following topics will be stressed in the proseminar: American colonization; racial origins; the beginnings of agriculture, industry and commerce; the expansion of the frontiers; the movement for independence; constitution-framing; the party system of government; cultural tendencies and progress toward social betterment; the problem of states' versus national rights; the era of great industry. Summer session.

Mr. Harmon

Hist. 315. Political and Social History of England (3)

The history of the rise and growth of English political and social institutions prior to 1603. First semester.

Mr. Cowherd

Hist. 316. Political and Social History of England (3)

The history of the development of English political and social institutions from the death of Elizabeth to the present. Emphasis is placed upon the political and intellectual legacy bequeathed to the modern world as a result of this development. Second semester.

Mr. Cowherd

Hist. 317. The Middle East in World History (3)

A survey of the rise of civilization in the Middle East from the times of earliest recorded history until the capture of Constantinople by the Turks in 1453, with special emphasis upon the legacy of Egypt, Persia, and the Hebrew people; oriental and western ideas during Hellenistic and Roman times; rise of Byzantium; rise of Islam and the development of Islamic civilization; Crusades and final triumph of the Ottoman Turks. First semester.

Mr. Aiken

Hist. 318. The Middle East in World History (3)

Continuation of Hist. 317. The relations between Europe, America, and the Middle East during the heyday and decline of Ottoman power; western imperialism in the Middle East; Zionism; the strategic importance of this great land bridge between the three continents in modern times to the present day, including the struggle for the control of communication by land, sea, and air, and the control of the vast petroleum reserves in this area. Second semester.

Mr. Aiken

Hist. 319. Eighteenth Century European Civilization (3)

This course is concerned with eighteenth-century European civilization. The constitutional, political, economic and social developments within, and institutions of the more dynamic European states of Great Britain, France, Prussia, and Russia will be contrasted and compared. First semester.

Mr. Kyte

Hist. 320. Eighteenth Century European Imperialism (3)

This course is concerned with eighteenth-century imperialism. The constitutional, political, economic and social developments within, and institutions of the New World empires of Great Britain, France, Spain, and Portugal when at the height of their power will be contrasted and compared. Second semester.

Mr. Kyte

Hist. 327. Development of American Institutions (3)

The colonial origin and national expansion of social, cultural, religious and economic institutions to 1865. First semester.

Mr. Cowherd

Hist. 328. Development of American Institutions (3)

A continuation of History 327. Developments from the Civil War to the present, with emphasis on industrialization, urbanization, the populist and progressive movements, and social changes as factors in institutional development. Second semester.

Mr. Cowherd

Hist. 329. American Foreign Policy (3)

The French alliance; independence and boundaries; commercial restrictions; French Revolution and neutrality; purchase of Louisiana; War of 1812; acquisition of Florida; Monroe Doctrine; relations with France and Great Britain, Oregon and Texas; the Mexican War. First semester.

Mr. Harmon

Hist. 330. American Foreign Policy (3)

The Civil War and possible European intervention; Alaska boundary; War with Spain; the new Caribbean policies; the World War of 1914-1918 and its aftermath; diplomatic events preceding Pearl Harbor; outbreak and prosecution of the war; plans for peace. Second semester.

Mr. Harmon

Hist. 331. The Intellectual Expansion of Modern Europe, 1300 to 1789 (3)

A study of the heritage bequeathed to modern Europe by the cultural achievements and traditions of the Renaissance, Reformation, and the 17th

century. Special attention will be paid to scientific and technological development and to the growth of political thought and theory during these centuries. First semester. Mr. Haight

Hist. 332. The Intellectual Expansion of Modern Europe, 1789 to the Present (3)

A continuation of the preceding course, the enlightenment to the present, with special attention paid to the effect upon modern thought of the industrial revolution and the rapid advancement in technology. Second semester. Mr. Haight

Hist. 341. Expansion of the English-speaking Peoples, 1100 to 1775 (3)

A study of the political, economic, and social implications of the expansion of the English-speaking peoples throughout the world from the time of the Crusades to the time of the American Revolution. First semester.

Mr. Aiken

Hist. 342. Expansion of the English-speaking Peoples, 1775 to the Present (3)

A study of the political, economic, and social growth of the English-speaking communities throughout the world from the time of the American Revolution to the outbreak of the World War II. Second semester.

Mr. Cowherd

Hist. 343. Tudor England (3)

Political, institutional, social and cultural history of England from 1485 to 1603. First semester.

Mr. Aiken

Hist. 344. Stuart England (3)

Political, institutional, social and cultural developments in England from 1603-1715. Second semester.

Mr. Aiken

Hist. 349. Hispanic America in the Nineteenth Century (3)

Successful movements for independence and recognition; types of governments formed in South, Central, and Caribbean America; wars and revolutions; problems pertinent to foreign trade; application of the Monroe Doctrine and its acceptance. First semester.

Mr. Kyte

Hist. 350. Hispanic America in the Twentieth Century (3)

Continuation of Hist. 349. Results of the Spanish American War; Theodore Roosevelt and "big stick" diplomacy; Panama Canal and world trade; debts and interventions; Pan-Americanism; World War I and its influence; recent United States relations with Latin America. Second semester.

Mr. Kyte

Hist. 351. Special Topics in History (3)

Intensive study in an area of history not adequately covered in currently listed offerings. The field of research may be varied from time to time and the course may be administered as a reading program or otherwise as may best seem fit to meet the needs of students of unusual ability and adequate preparation. *Prerequisite: Consent of the head of department.*

Hist. 352. Special Topics in History (3)

Continuation of Hist. 351. *Prerequisite: Consent of the head of department.*

Hist. 360. History of American Political Parties (3)

Evolution of major and minor political parties, including the Federalist and Anti-Federalist, the Democratic and Republican, the Populist and Progressive; party organization and functions; the economic and sectional basis of politics; nomination and election methods; the conduct of campaigns. Summer session.

Mr. Harmon

For Graduates

Graduate students desiring to major in history and government should have had at least twelve semester hours of undergraduate work that bear upon this field or in other ways should satisfy the department that they are in a position to undertake profitably the required program of study.

Candidates for the master's degree may qualify either by completing successfully thirty hours of approved course work and passing an examination covering the entire field or by completing twenty-four hours in approved courses and submitting a satisfactory thesis. Each candidate will select, upon the advice and with the approval of the head of the department, the plan better suited to his needs and abilities.

All graduate students majoring in history and government are expected to take Hist. 401 and 402, Research Methods in the Social Sciences.

Hist. 401. Research Methods in the Social Sciences (3)

Technique of research along the lines of historical method; training in the critical handling of documentary materials, in measuring the value of evidence, and in formal presentation of the results of research. Required of all graduate students in history and government. First semester.

Mr. Kyte

Hist. 402. Research Methods in the Social Sciences (3)

In this course the emphasis will be placed upon historiography. Second semester.

Mr. Kyte

Hist. 403. Modern Europe, 1789-1870 (3)

Era of Metternich; Congress of Vienna and reconstruction of Europe; industrial revolution and subsequent social reforms; France and Germany; democracy and nationalism; Second French Empire; unification of Italy and Germany. First semester.

Mr. Haight

Hist. 404. Modern Europe since 1870 (3)

Latin and Teutonic Europe; Great Britain and Ireland; Russia and the Dardanelles; Turkey and Europe; nationalism and the new imperialism; World War I and the Treaty of Versailles; League of Nations; national socialism vs. democracy; thirst for power; World War II and its aftermath. Second semester. Mr. Haight

Hist. 411. England under the Tudors (3)

An intensive study of political, institutional and social history during the period 1485-1603. First semester. Mr. Aiken

Hist. 412. England under the Stuarts (3)

An intensive study of religious, political, institutional and social history during the period 1603-1760. Second semester. Mr. Aiken

Hist. 413. Modern England—The Age of Reform, 1760-1890 (3)

A study of industrial England, liberal and humanitarian reforms, and the growth of colonial self-government. First semester. Mr. Cowherd

Hist. 414. Modern England—The Age of Conflict, 1890—to the present (3)

The growth of socialism, the rise of the Labor Party, the expansion of empire, formation of the Commonwealth, and the origins and consequences of two World Wars will be studied. Second semester. Mr. Cowherd

Hist. 421. English Colonization in North America in the Seventeenth Century (3)

The activities of the overseas trading companies, proprietors, and royal governors, and the founding and development of the English colonies in the West Indies and along the shores of North America. First semester. Mr. Kyte

Hist. 422. America in the Eighteenth Century (3)

A continuation of Hist. 421, with emphasis upon the workings of the mercantile system, the evolution of colonial institutions, the development of imperial administration, and the causes, events, and results of the wars with France and the War for American Independence. Second semester. Mr. Kyte

Hist. 423. American Constitutional History (3)

The major problems involved in the growth of the powers of the national government. First semester. Mr. Harmon

Hist. 424. American Constitutional History (3)

Continuation of Hist. 423. Second semester. Mr. Harmon

Hist. 425. The United States, 1776-1800 (3)

Revolutionary movement and the Revolution; patriots and loyalists; diplomats and diplomacy; early state constitutions and the Articles of Confederation; Constitutional Convention of 1787 and the Constitution; Feder-

alists in control; plots and conspiracies; rise of the Republican party; downfall of the Federalists. First semester. Mr. Harmon

Hist. 426. The United States, 1800-1850 (3)

Jeffersonian democracy; territorial expansion; War of 1812; new nationalism; sectionalism; protective tariffs; slavery and expansion; Texas; Mexican War; compromise measures of 1850. Second semester. Mr. Harmon

Hist. 427. The United States, 1850-1898 (3)

Background of the Civil War; rise of the Republican party; Buchanan's policy; election of 1860; Lincoln's attitude; views of Northern and Southern leaders; war powers of the President; downfall of the Confederacy; reconstruction; Grant's administration; big business; organized labor; granger movement; Bryan and silver; Cuba and Spain. (Not offered 1955-56)

Mr. Harmon

Hist. 428. The United States since 1898 (3)

Causes and results of the Spanish-American War; insular possessions; Theodore Roosevelt's policies; Progressive movement; Wilson and reform; World War I; speculative 1920's; the great depression; Democrats in control; Franklin D. Roosevelt's domestic and foreign policies; aftermath of World War II. (Not offered 1955-56)

Mr. Harmon

Hist. 431. America as a World Power (3)

The results of the Spanish-American War; the United States' Pacific possessions; Theodore Roosevelt and world affairs; Knox and "Dollar Diplomacy"; World War I; American neutrality; the United States as a belligerent; the Treaty of Versailles. First semester.

Messrs. Cowherd and Harmon

Hist. 432. America as a World Power (3)

The United States and the League; the reconstruction of Europe; the rise of Hitler; World War II and its aftermath; the Monroe Doctrine; the Good Neighbor Policy; the problems of the Pacific; China and Japan; Japan and the United States; the War with Japan; Red China and the Korean crisis. Second semester.

Messrs. Cowherd and Harmon

GOVERNMENT

Govt. 1. The Foundations of Government (3)

A survey of the basic principles and problems of governmental organization and operation, with emphasis on controversial issues and on the relevant political institutions and practices, both contemporary and past, of American, European, and Asiatic peoples. First and second semesters.

Govt. 2. American Political Ideas (3)

A survey of the ideas underlying and associated with the political institutions and practices of the United States. Second semester.

Govt. 3. Foreign Governments (3)

The governmental systems of various foreign countries, in particular, those with authoritarian regimes. *Prerequisite: Sophomore standing.* First semester.

Govt. 4. Political Parties and Electoral Problems (3)

The organization, functions, and techniques of political parties; pressure groups and pressure politics; nomination and election methods. Second semester.

Govt. 6. Democracy (3)

An analysis of the theory and the practice of democratic government in selected countries. *Prerequisite: Sophomore standing.* Second semester.

Govt. 51. American National Government (3)

Constitutional principles; organization and operation of the national government; the party system; citizenship and civil rights. *Prerequisite: sophomore standing.* First semester.

Govt. 52. American State and Local Government (3)

The position of the states in the union; machinery and functions of state governments; nominations and elections; the various systems of local government. *Prerequisite: sophomore standing.* Second semester.

Govt. 101. History of Political Thought (3)

History of leading political ideas. Analysis of the views of representative ancient, medieval, and modern political philosophers of the western world. First semester.

For Advanced Undergraduates and Graduates

Govt. 351. Constitutional Law (3)

The law of the Constitution as expounded by the Supreme Court of the United States. First semester. Messrs. Schulz, Tresolini

Govt. 352. Civil Rights (3)

A study of constitutional guarantees designed to protect the individual against arbitrary, unreasonable, and oppressive government. Freedom of speech and of the press, religious freedom, freedom of assembly, property rights. Constitutional problems concerning crime and its punishment. Second semester. Messrs. Schulz, Tresolini

Govt. 354. Administrative Law (3)

Consideration of the authority, procedures, and methods utilized by executive agencies in the administration of public policy. Analysis of the general problem of adjusting the administrative process to traditional constitutional principles. Second semester. Mr. Tresolini

Govt. 357. City Government (3)

The machinery and processes of city government in the United States; city-state and federal-city relations; the problems of metropolitan areas; forms of city government, with special emphasis on the operation of the council-manager plan. First semester. Mr. Schulz

Govt. 359. Law-making (3)

Organization and procedure of legislative and constituent assemblies. Legislative leadership. Role of administrative and judicial agencies in law-making. Pressure groups, parties, and policy determination. Direct legislation. First semester. Mr. Tresolini

Govt. 360. Public Administration (3)

The nature of administration; problems of organization and management; public personnel policies; budgeting and budgetary systems; forms of administrative responsibility. Second semester.

Messrs. Schulz, Tresolini

Govt. 363. Contemporary Political Thought (3)

Analysis of the basic concepts of political science: state, government, sovereignty, law, liberty, rights; consideration of authoritarian and popular government; federal and unitary systems. First semester. Mr. Schulz

Govt. 364. Contemporary Political Thought (3)

Theories concerning the proper role of the State in society and the ethical justification of political coercion; political aspects of anarchism, communism, socialism, fascism, and political pluralism. Second semester.

Mr. Schulz

For Graduates

Govt. 451. American Political Institutions (3)

The federal and state constitutions; Congress and the state legislatures; the presidency; state governors; the judicial system; political parties; nomination and election methods; local government; the council-manager plan. First semester. Mr. Tresolini

Govt. 452. American Political Institutions (3)

Continuation of Govt. 451. Second semester.

Mr. Tresolini

Govt. 463. Seminar in Political Theory (3)

Consideration of theories concerning the nature of the state, its origin, and its role in society. First semester. Mr. Schulz

Govt. 464. Seminar in Political Theory (3)

Continuation of Govt. 463. Second semester.

Mr. Schulz

INDUSTRIAL ENGINEERING

Professor Gould

Associate Professor Richardson

Assistant Professors Heiland, Kane

Mr. Aims

I.E. 100. Industrial Employment

Following the junior year, students in the industrial and mechanical engineering curriculum are required to do a minimum of eight weeks of practical work, preferably in the work they plan to follow after graduation. A report, typewritten and bound, is required. *Prerequisite: sophomore standing.*

I.E. 105. Thesis (3)

Candidates for the bachelor's degree in industrial engineering may, with the approval of the department staff, undertake a thesis as a portion of the work of the senior year. *Prerequisite: senior standing.*

I.E. 110. Engineering Economy (3)

Quantitative analysis of engineering proposals with emphasis on economic factors including recovery of first cost with a rate of return, depreciation, incremental costs and breakeven point costs; operations economy including optimum order size, crew size, and performance ratios. *Prerequisite: Eco. 3, 4. First semester.*

I.E. 114. Plant Administration (3)

The physical plant, its organization, and operation. Lectures, problem exercises, trips, and collateral reading. First semester.

I.E. 115. Personnel Administration (3)

Industrial personnel, their selection, training, care, and reward. Lectures, problem exercises, and collateral reading. Second semester.

I.E. 116. Plant Administration (3)

Continuation of I.E. 114. *Prerequisites: I.E. 114, Math. 233, previously or concurrently.* Second semester.

I.E. 162. Industrial Management (3)

A course in the essential problems of organization and management of industrial enterprises. Planned for students other than those in engineering. *Prerequisites: Eco. 3, 4. First semester.*

I.E. 164. Industrial Management (3)

An abridgement of I.E. 114 and I.E. 116. Planned primarily for engineering students other than those in industrial engineering. *Prerequisites: Eco. 3, 4. Second semester.*

For Advanced Undergraduates and Graduates

I.E. 321. Experimental Industrial Engineering (3)

Experimental projects in selected fields of industrial engineering, approved by the instructor. A written report is required. *Prerequisite: senior standing in industrial engineering and consent of instructor.* Staff

I.E. 322. Experimental Industrial Engineering (3)

Continuation of I.E. 321. *Prerequisite: senior standing in industrial engineering and consent of instructor.* Staff

I.E. 325. Production Control (3)

The coordination of an industry's activities to produce its commodities in sufficient quantity, of proper quality, and at the right time, for the least possible cost. Lectures, problem exercises, trips, and term projects. *Prerequisites: I.E. 110, 116.* First and second semester. Mr. Heiland

I.E. 326. Quality Control (3)

Industrial inspection methods; interpretation of results, based upon statistical techniques for improvement of product quality, for better coordination between design, production, and inspection, and for reduction of cost. Lectures, problem exercises, trips, and term project. *Prerequisites: I.E. 116, Math. 233.* Second semester. Messrs. Heiland, Kane

I.E. 327. Product Engineering (3)

The relationship and application of modern industrial processes, materials, and machines to product design for improvement of production, efficiency, product life, and consumer acceptance. Lectures, problem exercises, trips, and term project. *Prerequisites: I.E. 110, 116; M.E. 102; Met. 63.* First semester. Mr. Kane

I.E. 328. Work Simplification (3)

Process and product simplification, involving method study, time study and other analysis techniques. Lectures, problem exercises, trips, and term project. *Prerequisites: I.E. 114 and 115.* First and second semesters. Mr. Richardson

I.E. 329. Wage and Salary Administration (3)

The theory and practice of job evaluation, employee merit rating, and community wage surveys for the purpose of establishing salary levels which provide proper payment for various jobs, reward individual effort and merit, and meet competition. Lectures, problem exercises, and trips. *Prerequisite: I.E. 115.* First semester Mr. Gould

I.E. 330. Industrial Relations (3)

The policies, organization, and operation of an industrial relations department, based upon existing governmental regulations and current policies of organized labor. Lectures, problem exercises, and term project. *Prerequisite: I.E. 115.* Second semester. Mr. Gould

I.E. 350. Industrial Engineering Problems (1)

Comprehensive study of problems encountered in manufacturing with special attention to organizational relationships and the inter-dependence of the various functions such as quality control, production control, product engineering, labor relations and cost control. *Prerequisite: Senior standing in Industrial Engineering.* Second semester. Staff

For Graduates

The prerequisite for graduate work in industrial engineering is a course of study equivalent to that required for the B.S. in I.E. at Lehigh University. Graduates of other engineering curricula may be required to devote additional time to prerequisite and basic courses. Subject to proper approval, a graduate major may include a maximum of nine hours from the following two groups with no more than six hours from each group: (1) "400" level courses in other branches of engineering; (2) Psych. 405 and Psych. 406, Seminar in Applied Psychology; Eco. 431, Managerial Economics; Eco. 433, Labor Management Economics.

I.E. 400. Management Policies (3)

Analysis of the factors entering into the determination of management policies; discussion of case material bearing upon the organization, location, growth, size, socialization, and control of types of industries. First semester. Mr. Richardson

I.E. 402. Personnel Policies (3)

Analysis of the factors entering into the determination of personnel policies; discussion of case material bearing on the worker and his relation to industry. Second semester. Mr. Gould

I.E. 405. Special Topics in Industrial Engineering (3)

An intensive study of some special field of industrial engineering. Staff

I.E. 406. Advanced Methods and Time Study (3)

A critical evaluation of methods and time study procedures and research techniques including systems analysis, motion picture techniques, ratio delay studies, predetermined standard times, and the construction of standard data. Mr. Richardson

I.E. 407. Operations Analysis and Control (3)

A study of planning and control activities in a manufacturing organization with emphasis on quantitative techniques of analysis. Mr. Gould

INTERNATIONAL RELATIONS

Professor Godshall

Assistant Professors Dunlap, Joynt

Mr. Yasuzi Hironaka

I.R. 1. Diplomacy (3)

Elements of international politics; scrutiny of the methods and objectives of diplomacy, with particular emphasis upon illustrative examples

drawn from contemporary affairs, portraying the forces and ideas molding of action of statesmen, acting within and outside the established national and international institutions. (Offered Summer, 1955)

I.R. 2. Diplomacy (3)

Continuation of Int. Rel. 1. Second semester.

I.R. 11. The Diplomacy of Europe 1815-1919 (3)

The development of alliances and other associations of nations, with resultant tensions and frictions; the causes of successive wars; the character of peace settlements; the formation of international institutions. First semester.

I.R. 12. The Diplomacy of Europe since 1919 (3)

Continuation of I.R. 11. Second semester. (Offered Summer, 1955.)

I.R. 21. The Diplomacy of the Far East to 1919 (3)

The opening of China and Japan; the transformation of Japan; the partition of China; international rivalries in Korea, Manchuria, the Philippines, Southeastern Asia and the Indies; economic and territorial imperialism. First semester.

I.R. 22. The Diplomacy of the Far East since 1919 (3)

An analysis of recent and contemporary political and economic problems confronting not only the countries of the Orient but the Western powers with interest in that region; Japan's aspirations to establish a New Order in Greater East Asia; frustration and remotivation of Japan; the spread of communism and its consequences; prerequisites for peace and security in the Far East and the Pacific region. Second semester.

I.R. 133. The Diplomacy of Russia and the Middle East to 1917 (3)

Development and expansion of the Russian Empire; principles of Russian foreign policy and their specific applications under the Tsarist and Provisional Governments, treated partially as backgrounds of Soviet policy; interaction between Russian domestic and foreign affairs. First semester.

I.R. 134. The Diplomacy of Russia and the Middle East since 1917 (3)

A topical and chronological survey of Russian foreign relations in the Soviet period; philosophical, psychological, economic, social and other factors influencing the formulation and execution of foreign policy; interaction between Soviet domestic and foreign affairs. Second semester.

For Advanced Undergraduates and Graduates

I.R. 312. World Affairs since 1919 (3)

The peace treaties of 1919; ideals and realities of the League of Nations, efforts to effect disarmament; resurgence of power politics as displayed by the German-Italian-Japanese Axis; appeasement; frustration; the war of

1939-1945; post-war occupation of Axis countries; problems of reconciliation of conflicting objectives and interests among the victors. (Offered Summer 1956) Messrs. Dunlap, Joynt

I.R. 322. The Far East in World Affairs (3)

Japanese and other quests for hegemony through extension of influence and control; decline of Western prestige and power; nationalist movements; Communist China as a contestant for Power status. (Offered Summer 1955) Mr. Joynt

I.R. 322. The Soviet Union in World Affairs (3)

An appraisal of the objectives and tactics of Soviet diplomacy, with particular emphasis upon Russian status as one of the great powers and upon contemporary Soviet-American relations and their background. (Offered Summer 1956) Mr. Dunlap

I.R. 341. International Relations (3)

Pro-seminar. Basic concepts in World politics; elements in international cooperation in dealing with historic and current issues of international politics. *Prerequisite: Consent of the head of the department.* First semester. Mr. Godshall

I.R. 342. International Relations (3)

Continuation of I.R. 341. *Prerequisite: Consent of the head of the department.* Second semester. (Offered Summer 1955) Mr. Godshall

I.R. 351. International Organization (3)

Constitutional and political character of successive agencies of international organizations, with emphasis upon the League of Nations. First semester. Mr. Joynt

I.R. 352. International Organization (3)

Continuation of Int. Rel. 351, with emphasis upon the United Nations. Second semester. Mr. Joynt

I.R. 361. International Law (3)

Consideration of the principles and rules generally recognized as binding upon the community of nations in time of peace; recognition of the existence and termination of states; nationality and protection of persons; acquisition and loss of territory; control over territorial waters; piracy; asylum, state responsibility and international claims; human rights. First semester. Mr. Dunlap

I.R. 362. International Law (3)

Settlement of disputes; principles applicable to the conduct of hostilities in wartime; rules of war; treatment of prisoners; transfer of property; establishment and disposition of "war guilt"; recognition of governments instituted by force; problems of neutrality. Second semester. Mr. Dunlap

I.R. 371. Readings in International Relations (3)

Directed studies and readings in the several fields of international relations, designed for the student who has a special competence or interest in some area not covered by regularly rostered courses. *Prerequisite: Consent of the head of the department.* First semester. Staff

I.R. 372. Readings in International Relations (3)

Continuation of I.R. 371. *Prerequisite: Consent of the head of the department.* Second semester. Staff

For Graduates

Candidates for the master's degree may qualify either by completing successfully thirty hours of approved course work in this and cognate departments and passing an examination covering the entire field or by completing twenty-four hours in approved courses and submitting a satisfactory thesis. Each candidate will select the plan better suited to his needs and abilities, upon the advice and with the approval of the head of the department, and may be required to take a comprehensive written and oral examination.

Subject to proper approval, a graduate major in international relations may include courses chosen from the following list: Hist. 401, 402, Research Methods in the Social Sciences; Hist. 403, 404, Modern Europe; Hist. 431, 432, America as a World Power; Hist. 351, 352, Special Topics in History; Fin. 241, 342, International Trade and Finance; Fin. 371, 372, Readings in Finance; Eco. 371, 372, Readings in Economics.

I.R. 441. Seminar in International Relations (3)

Intensive analysis of selected forces and problems of world politics. First semester. (Offered 1957-58) Mr. Godshall

I.R. 442. Seminar in International Relations (3)

Continuation of I.R. 441. Second semester. (Offered 1957-58)

Mr. Godshall

I.R. 451. Seminar in International Organization (3)

Intensive analysis of selected agencies and activities of the League of Nations and affiliated institutions. First semester. (Offered 1956-57)

Mr. Joynt

I.R. 452. Seminar in International Organization (3)

Continuation of I.R. 451 with emphasis upon the United Nations. Second semester. (Offered 1956-57).

Mr. Joynt

I.R. 461. Seminar in International Law (3)

Intensive analysis of the principal theories concerning the nature of international law and its fundamental conceptions, with special studies of

MATHEMATICS AND ASTRONOMY

their application and significance in contemporary international society.
First semester. (Offered 1955-56) Mr. Dunlap

I.R. 462. Seminar in International Law (3)

Continuation of I.R. 461. Second semester. (Offered 1955-56)
Mr. Dunlap

JOURNALISM

See English

LATIN

See Classical Languages

LAW

See Accounting

MATHEMATICS AND ASTRONOMY

Professors Raynor, Shook and Pitcher

Associate Professors Cutler, Latshaw, Beale, Wilansky,
Lamson and Hailperin

Assistant Professors Van Arnam, Hsiung and Goldberg

Messrs. Schatz, Carson, Gulden, Yen, Halpern (Mrs.),
Burke, Dorff, Green, Old, Korsch, Oglesby, Scott and Yingst

In the department of mathematics and astronomy undergraduate majors are offered in mathematics, in mathematics and astronomy, and in actuarial science. For details of the requirements see the outline of major sequences in the section describing the College of Arts and Science.

Students who offer for entrance elementary and intermediate algebra, plane geometry and plane trigonometry and whose proposed course of study requires Math. 11 are required to take a placement test in mathematics during Freshman Week. Those whose performance in the test is unsatisfactory must take and pass Math. 0 before being allowed to enroll in Math. 11.

MATHEMATICS

Math. 0. Mathematics Review (0)

A review of algebra and plane trigonometry. First and second semesters.

Math. 1. Plane Trigonometry (3)

First semester.

Math. 10. General Mathematics for Students of Business (3)

Review of elementary algebra; graphs and charts, the straight line law, the law of the parabola; logarithms; arithmetic and geometric progression; the exponential law, the power law; curve fitting, permutations, combinations, and probability. First and second semesters.

Math. 11. Analytic Geometry (3)

Algebra review; the straight line; rational fractional functions; transformation of coordinates; conic sections; trigonometric curves; parametric equations; polar coordinates. *Prerequisite: Math. 1 or entrance credit in plane trigonometry.* First and second semesters.

Math. 12. Calculus I. (3)

Derivatives, geometrical and physical applications; differentiation of algebraic functions; higher derivatives; maxima and minima; differentials; indefinite integrals; definite integrals, geometrical and physical applications; differentiation of transcendental functions. *Prerequisite: Math. 11.* First and second semesters.

Math. 13. Calculus II (3)

Hyperbolic functions; curvature; curvilinear motion; technique of integration; further geometrical and physical applications; approximate integration; solid analytic geometry. *Prerequisite: Math. 12.* First and second semesters.

Math. 14. Calculus III (3)

Intermediate forms; Taylor's formula with remainder; infinite series; partial derivatives; multiple integrals; elementary differential equations. *Prerequisite: Math. 13.* First and second semesters.

Math. 15. Reading Course in Mathematics (1)

Credit not to exceed one hour per semester, total credit not to exceed three hours; approval of program and written report required. *Prerequisite: Consent of head of department.* First and second semesters.

Math. 16. Solid and Spherical Geometry and Spherical Trigonometry (3)

Open to all students, particularly advised for students of astronomy. Given when there is sufficient demand. *Prerequisite: Math. 1.* First semester.

Math. 23. General Mathematics for Students of Business-Second course (3)

Fundamental ideas of analytic geometry and calculus, and selected topics of algebra, with numerous applications to problems of business and the social sciences. *Prerequisite: Math. 10.* Second semester.

Math. 40. Mathematics of Finance (3)

Compound interest, and elementary treatment of annuities, etc. *Prerequisite: Math. 10 or 11.* Second semester.

Math. 42. Introduction to Mathematics of Statistics (3)

Frequency tables; averages; probability; the normal curve; sampling theory; correlation theory in two-way space. *Prerequisite: Math. 10.* Second semester.

Math. 43. First Course in Mathematics of Life Insurance (3)

Mathematical theory of life contingency; preparation of life and monetary tables; computation of premiums for various life insurance policies; valuation of policies to meet statutory requirements; mathematical theory of risk and cost of insurance; computation of items for annual reports; valuation of life annuities. *Prerequisite: Math. 40.* First or second semester.

Math. 51. Advanced Algebra (3)

Number systems; properties of integers; theory of polynomial functions and equations; determinants and systems of linear equations; elimination theory. *Prerequisite: Math. 12.* First semester.

Math. 54. Higher Geometry (3)

An introductory course in projective geometry and non-euclidean geometry. *Prerequisite: Math. 12.* Second semester.

Math. 102. Finite Differences (3)

Definition of differences of various orders; the operators Δ and E ; interpolation formulas for both equal and unequal intervals; central difference interpolation formulas; inverse interpolation; finite summation; differences of zero; relations between the operators Δ and D ; differences of a product; finite summation by parts; some modern extensions and special devices for interpolation and summation; numerous examples illustrating the use of the theory. *Prerequisite: Math. 14.* First or second semester.

Mr. Beale

Math. 123. Probability (3)

A course designed primarily for students majoring in actuarial science. *Prerequisite: Math. 14.* First semester.

Mr. Beale

For Advanced Undergraduates and Graduates

Math. 206. Applied Mathematics I (3)

Determinants and matrices; simultaneous ordinary differential equations; Fourier series; series solutions of differential equations; Bessel functions; vector algebra and calculus; line and surface integrals; divergence theorem; Green's theorems; Stokes' theorem; geometrical and physical applications. *Prerequisite: Math. 14.* First and second semesters.

Staff

Math. 208. Applied Mathematics II (3)

Continuation of Math. 206. The Laplace transformation with applications to differential equations; partial differential equations and boundary value problems; functions of a complex variable, including conformal mapping and applications to physical problems. *Prerequisite: Math. 206.* Second semester. Staff

Math. 219. Principles of Analysis (3)

The real number system; limits; continuous and discontinuous function; differentiation; integration; infinite series; absolute and uniform convergence; functions of more than one variable; implicit functions. Required of majors in mathematics. *Prerequisite: Math. 14.* First semester

Mr. Hailperin

Math. 220. Principles of Analysis (3)

Continuation of Math. 219. Required of majors in mathematics except majors in actuarial science. *Prerequisite: Math. 219.* Second semester

Mr. Hailperin

Math. 221. Differential Equations (3)

Special solvable non-linear equations, linear equations, transformations, and symbolic methods; solutions in series; Ricatti's, Bessel's, and Legendre's equations. *Prerequisite: Math. 14.* First semester.

Messrs. Cutler, Shook

Math. 233. Mathematical Statistics (3)

Moments; moment generating function; normal distribution function; Poisson distribution function; large sample theory of a single variable; linear regression and linear correlation; distribution functions of two variables; small sample distributions; the chi square distribution; Student's *t* distribution. *Prerequisite: Math. 13.* Second semester.

Messrs. Latshaw, Carson

Math. 301. Vector Analysis (3)

The theory and method of vector analysis as applied in physics and pure mathematics. *Prerequisite: Math. 14.* First and second semesters.

Messrs. Cutler, Shook

Math. 303. Mathematical Logic (3)

An introductory course in symbolic logic designed primarily to acquaint the student with the principles of reasoning used in mathematics and with symbolic logic as a mathematical theory. Applications to relay-circuit design and programming of high speed electronic computers are discussed. First or second semester.

Mr. Hailperin

Math. 309. Theory of Probability (3)

Discrete and continuous sample spaces; random variables; conditional probability and statistical independence; binomial, Poisson and normal distribution; limit theorems; random walk problems; Markov chains; time-dependent stochastic processes. The theory will be applied to problems in statistics, physics and biology, *Prerequisite: Math. 14.* First or second semester.

Mr. Latshaw

Math. 315. Theory of Functions of a Complex Variable (3)

Algebra of complex numbers; analytic functions; Cauchy-Riemann equations; Laplace's equation; conformal mapping; integrals of complex functions; Cauchy's theorem; power series; Taylor's theorem; Laurent's theorem; residues; applications to physical and geometrical problems. *Prerequisite: Math. 206, or Math. 219.* First and second semesters.

Mr. Carson

Math. 322. Differential Equations and Harmonic Analysis (3)

Continuation of Math. 221. Partial differential equations, Fourier series, cylindrical and spherical harmonics. *Prerequisite: Math. 221 or consent of the instructor.* Second semester.

Messrs. Cutler, Shook

Math. 324. Theory of Errors and Least Squares, Empirical Formulas (3)

Probability; least squares and its application in the study of errors; formation of empirical formulas; numerical methods. Designed for students engaged in experimental or observational work. *Prerequisite: Math. 14.* First and second semesters.

Mr. Latshaw

Math. 340. Higher Algebra (3)

Theory of matrices and linear transformations; linear spaces; bilinear and quadratic forms. *Prerequisite: consent of instructor.* First semester.

Mr. Schatz

Math. 341. Higher Algebra (3)

Some basic concepts of higher algebra; groups, rings, fields, lattices; algebra of classes; Boolean algebra. *Prerequisite: Math. 340.* Second semester.

Mr. Schatz

For Graduates

Math. 401. Elementary Theory of Functions of Real Variables (3)

Classes, functions and relations; postulational development of positive integers; construction of real number systems; elementary inequalities; convergence of infinite series and infinite products; real functions of real variables; derivatives; Riemann integral; existence theorems. First semester.

Messrs. Pitcher, Wilansky

Math. 402. Theory of Functions of Real Variables (3)

Lebesgue measure and the Lebesgue integral; functions of bounded variation; absolute continuity; differentiation and integration as inverse processes; multiple and iterated integrals; Fourier series; convergence in the mean; Riesz-Fischer theorem. *Prerequisite: Math. 401.* Second semester.

Messrs. Pitcher, Wilansky

Math. 405. Partial Differential Equations (3)

Classification and transformation of equations; theory of characteristics; initial and boundary value problems; Cauchy's problem for hyperbolic

equations; Dirichlet's problem for elliptic equations; potential theory; Green's function; harmonic and sub-harmonic function; difference equations; applications to equations of physics. *Prerequisites: Math. 206, Math. 221.* First semester. Mr. Shook

Math. 406. Partial Differential Equations (3)

Continuation of Math. 405. *Prerequisite: Math. 405.* Second semester. Mr. Shook

Math. 409. Mathematics Seminar (3)

An intensive study of some field of mathematics such as differential equations; integral equations; mathematical logic; advanced topics in complex variable theory; etc. *Prerequisite: Consent of instructor.* First semester. Staff

Math. 410. Mathematics Seminar (3)

Continuation of Math. 409. *Prerequisite: Consent of instructor.* Second semester. Staff

Math. 416. Theory of Functions of a Complex Variable (3)

More detailed and more rigorous treatment of the theory of analytic functions than in Math. 315, with more advanced topics, such as: polygenic functions, theory of conformal mapping, bilinear transformations, uniform convergence of series, analytic continuation, summability of series, multiple-valued functions, Riemann surfaces, infinite products, Weierstrass' factor theorem, Mittag-Leffler's theorem, periodic functions, elliptic functions, Gamma functions, theory of linear differential equations, Bessel functions. *Prerequisite: Math. 315.* Second semester. Mr. Carson

Math. 417. Theory of Elasticity (3)

Theory of stress and strain; tension and thrust with applications; bending of rods and plates; equilibrium of curved rods, cylinders, and spheres. *Prerequisite: Math. 206.* First semester. Mr. Raynor

Math. 418. Theory of Elasticity (3)

Continuation of Math. 417, with an introduction to the theory of plasticity. *Prerequisite: Math. 417.* Second semester. Mr. Raynor

Math. 423. Differential Geometry (3)

The differential geometry of curves and surfaces in Euclidean space, including problems in the large. First semester. Messrs. Cutler, Hsiung

Math. 424. Differential Geometry (3)

Continuation of Math. 423. Riemannian geometry and geometry of differentiable manifolds. *Prerequisite: Math. 423.* Second semester. Messrs. Cutler, Hsiung

Math. 429. Advanced Analytic Mechanics (3)

Conservative and non-conservative fields; generalized co-ordinates; Lagrange's equations; Hamilton's canonical equations; holonomic and non-

holonomic system; gyroscopic motion, etc. *Prerequisite: Consent of instructor.* First semester. Mr. Raynor

Math. 430. Advanced Analytic Mechanics (3)

Continuation of Math. 429. *Prerequisite: Math. 429.* Second semester. Mr. Raynor

Math. 431. Calculus of Variations (3)

Fundamental existence theorems of analysis; the classical theory of necessary and of sufficient conditions for relative minima of single integrals; fields of extremals and the Hamilton-Jacobi theory; numerous physical and mechanical applications and extensions, to be chosen according to the special interests of the students. Second semester. Mr. Pitcher

Math. 435. Functional Analysis I. (3)

Transfinite induction; linear space; convex sets, separation theorems; point-set topology and linear topology; Frechet, Banach, Hilbert and Minkowski spaces, and Banach algebra; ordered spaces; reflexivity, weak and product topologies; open mapping, uniform boundedness; basis and orthogonal series; representation theorems; applications to classical analysis. Desirable preparation: Math. 401, and Math. 442. First semester.

Mr. Wilansky

Math. 436. Functional Analysis II. (3)

Continuation of mathematics 435. *Prerequisite: Math. 435.* Second semester. Mr. Wilansky

Math. 442. Introduction to Topology (3)

Elements of point-set topology, with emphasis on applications to Euclidean spaces and spaces of functions; combinatorial topology, with applications on connectivity. *Prerequisite: Consent of instructor.* Second semester. Messrs. Pitcher, Goldberg, Gulden

Math. 450. Modern Algebra (3)

The development of a topic from the field of modern algebra, e.g. linear algebra, rings with minimal conditions, Galois theory of equations, valuation theory, lattice theory. Second semester. Messrs. Goldberg, Schatz

Math. 453. Modern Methods in the Theory of Functions of a Complex Variable (3)

Analytic continuation; principle of maximum modulus; conformal representation; Taylor series analysis; integral functions; Dirichlet series. *Prerequisite: Math. 416.* First semester. Mr. Carson

ASTRONOMY

Astr. 1. Descriptive Astronomy (3)

The earth as an astronomical body; the solar system; a brief introduction to sidereal astronomy. First and second semesters.

Astr. 2. General Astronomy (3)

The solar system; the sidereal system, with an introduction to celestial mechanics and astrophysics. *Prerequisite: Math. 12.* First or second semester.

Astr. 103. Practical Astronomy (3)

Instruments used; methods of taking and reducing observations to determine times, latitude, and azimuth; observatory work in which each student makes his own observations and computations in illustration of the theory studied. *Prerequisite: Astr. 2.* Second semester.

Mr. Van Arnam

Astr. 104. Stellar Astronomy and Astrophysics (3)

Introduction to astrophysics; the sun considered as a star; physical characteristics of the stars; stellar motions; binary stars; theory of binary star orbits; stellar aggregations; cosmogony. *Prerequisites: Math. 13, and Physics 16 or Physics 23.* First or second semester.

Mr. Van Arnam

MECHANICAL ENGINEERING

Professors Hartman and Stuart

Associate Professors Jackson and Eppes

Assistant Professors Eichelberger and Kreith

Messrs. Parke, Benner, Adams, Harrach, Schlegel, Levien, Fung

M.E. 1. Machine Shop Practice (3)

This course is given for three weeks at the local technical high school during the summer session following the freshman year. Work on the various machine tools, use of hand tools, and the various methods of welding. Summer session.

M.E. 2. Elementary Machine Design (3)

A study of the kinematic principles in mechanisms and their application in machines. *Prerequisites: C.E. 61, Math. 12, Phys. 22.* First and second semesters.

M.E. 102. Machine Design (3)

Application of the principles of statics, dynamics, strength of materials, and kinematics to the design of machine elements. *Prerequisites: Mech. 111, M.E. 1, M.E. 2.* First and second semesters.

M.E. 103. Advanced Machine Design (3)

Vibration and balancing of machines; detailed design based on consideration of dynamic loading and fatigue. *Prerequisite: M.E. 102.* First semester.

M.E. 104. Thermodynamics (3)

Energy; steady flow and nonflow equations and applications; reversible cycles; Carnot principle; fundamental temperature scale; entropy; properties of liquids, vapors, gases, and mixtures. *Prerequisites: Math. 13, Phys. 23.* First semester.

M.E. 105. Thermodynamics (3)

Flow of elastic fluids through nozzles and orifices; cycles; the steam power plant; internal combustion engines; compressors; refrigeration. *Prerequisite: M.E. 104.* Second semester.

M.E. 106. Instruments Laboratory (1)

An introduction to mechanical engineering laboratory, covering a study of instruments, their construction, use, errors and calibration. *Prerequisite: Phys. 23.* First semester.

M.E. 107. Mechanical Engineering Laboratory (1)

Performance testing of power equipment and study of operational principles. *Prerequisites: M.E. 106 and M.E. 104.* Second semester.

M.E. 108. Mechanical Engineering Laboratory (2)

Experimental projects on power equipment, including engines, turbines, pumps, compressors, and refrigeration equipment, supplemented by lectures on laboratory methods and topics of general interest in mechanical engineering. *Prerequisite: M.E. 107 and M.E. 105.* First semester.

M.E. 109. Mechanical Engineering Laboratory (2)

Continuation of M.E. 108. Second semester.

M.E. 110. Thesis (3)

Candidates for the degree of B.S. in M.E. may, with the approval of the director of the curriculum, undertake a thesis as a portion of the work during the senior year.

M.E. 160. Heat Power (3)

Fuels; combustion; principles of engineering thermodynamics; properties of steam; steam power plant equipment and cycles; internal combustion engines. *Prerequisites: Math. 13, Phys. 23.* First and second semesters.

M.E. 161. Mechanical Engineering Laboratory (1)

Testing of mechanical engineering equipment. *Prerequisite: M.E. 160.* First and second semesters.

M.E. 162. Mechanical Engineering Laboratory (1)

Instruments, fluid flow, heat transfer. *Prerequisite: M.E. 104.* First semester.

M.E. 163. Mechanical Engineering Laboratory (1)

Tests on steam engines, turbines, compressors, refrigeration equipment, internal combustion engines. *Prerequisite: M.E. 162.* Second semester.

M.E. 166. Procedures for Mechanical Design (3)

Studies of the functions of basic machine elements and their combinations. Types of loading imposed by service conditions. Static and dynamic loads. Stress analysis applied to the design of typical machine elements. *Prerequisite: Mech. 111.* First semester.

For Advanced Undergraduates and Graduates

M.E. 320. Applied Thermodynamics (3)

Selected applications of thermodynamics to problems encountered in engineering practice. *Prerequisite: M.E. 105.* Mr. Stuart

M.E. 321. Heat Transfer (3)

Conduction, free and forced convection, radiation, evaporation and condensation, mass transfer. Application to design of heat exchangers in power plant, air conditioning and refrigeration apparatus. *Prerequisite: Math. 206; Mech. 121; M.E. 105.* Messrs. Kreith, Eppes

M.E. 322. Mechanics of Compressible Fluids (3)

Study of the behavior of compressible fluids; laminar and turbulent flow with boundary layer considerations; thermodynamic and dynamic analysis of flow of fluids. *Prerequisites: Mech. 121, M.E. 105.*

Messrs. Kreith, Jackson

M.E. 330. Air Conditioning and Refrigeration (3)

Psychrometric processes; heating and cooling load calculations; fluid flow and heat transfer principles applied to typical steam, hot water and air circulation systems; furnaces and heat transfer equipment; properties of refrigerants, analysis of refrigeration cycles and processes, applications; instrumentation. *Prerequisite: M.E. 105.* First or second semester.

Mr. Eppes

M.E. 333. Power Plants (3)

Study of the relation of the various pieces of power plant equipment to each other; calculations for the design of power plant elements; comparison of different types of plants driven by both steam and internal combustion engines; utilization of exhaust heat. *Prerequisite: M.E. 105 or Ch.E. 300.* Second semester.

Messrs. Stuart, Jackson

M.E. 334. Internal Combustion Engines (3)

Thermodynamics of internal combustion engine cycles; theory of spark ignition engines, Diesel engines, gas turbines and jet-propulsion; carburetion, fuel injection, supercharging. *Prerequisite: M.E. 105 or Ch.E. 300.*

Messrs. Jackson, Eppes

M.E. 340. Advanced Machine Design (3)

Project work on the design of a complete machine and study of adaptability of design to manufacturing considerations. Includes an introduction to the dynamics of engines, torque analysis, balancing, and flywheel design. Detailed design of selected engine components. *Prerequisite: M.E. 102.* Second semester.

Messrs. Hartman, Eichelberger

M.E. 341. Stress Analysis for Design (3)

Analytical and experimental methods of stress analysis applied to complex machine elements; experimental determination of proper distribution of material in highly stressed parts. *Prerequisites: M.E. 102, Math. 206.* First semester. Messrs. Hartman, Eichelberger

M.E. 342. Elementary Mechanical Vibration Analysis (3)

Analysis of physical systems and setting up equations; development of significant engineering relationships. Emphasis on engineering application. *Prerequisite: Math 206.* Second semester. Mr. Hartman

M.E. 343. Instrumentation and Automatic Control (3)

Selection, design and operation of measuring instruments. Analysis of automatic control systems for thermal, hydraulic and mechanical processes. Stability and response criteria. *Prerequisite: Math. 206.* First and second semester. Messrs. Hartman, Eppes, Jackson, Kreith

For Graduates

Subject to proper approval, a graduate major in mechanical engineering may include courses chosen from the following group: Math. 417 and 418, Theory of Elasticity; Math. 429 and 430, Advanced Analytic Mechanics; C.E. 400, Research Methods; Mech. 402, Advanced Analytical Mechanics.

M.E. 403. Advanced Mechanical Engineering Laboratory (3)

The planning, design, execution and reporting of experimental tests and investigations in mechanical engineering. First semester.

Mr. Jackson

M.E. 404. Advanced Mechanical Engineering Laboratory (3)

Continuation of M.E. 403. Second semester.

Mr. Jackson

M.E. 420. Advanced Thermodynamics (3)

Critical review of first and second laws, entropy, and general thermodynamic equations and relations; applications to current problems in technology and research, including properties of fluids, combustion, stable and metastable states, availability, and flow processes. First semester.

Mr. Stuart

M.E. 421. Advanced Thermodynamics (3)

Continuation of M.E. 420. Second semester.

Mr. Stuart

M.E. 422. Advanced Compressible Flow (3)

Flow of compressible fluids, including study of completely immersed bodies such as airfoils and turbine and compressor blades; internal flow with emphasis on Fanno and Rayleigh processes. Messrs. Kreith, Eppes

M.E. 423. Boundary Layer Analysis (3)

Navier-Stokes equations, laminar boundary layer theory, analysis of fric-

tion drag, heat transfer and separation; transition from laminar to turbulent flow. Turbulent boundary layer theory, Karman integral equations, Prandtl mixing length, turbulent friction drag, heat transfer and layer thickness. Flow in ducts, wakes and jets. First or second semester.

Messrs. Kreith and Eppes

M.E. 431. Compressors and Pumps (3)

Study of centrifugal, axial flow, reciprocating and rotary compressors and pumps. Theory, design and application.

Messrs. Stuart, Hartman

M.E. 432. Steam Turbines (3)

Theory of the steam turbine; discussion of types; design and calculation of parts; application to stationary and marine service.

Mr. Stuart

M.E. 433. Steam Power Plants (3)

Design and analysis of steam power cycles. Application of regenerative and reheat principles. Feed water heating and extraction calculations. Boiler, superheater, economizer and air heater performances. Principles of heat transfer as applied to the various elements of power plant equipment. Economics of plant location, fuel selection, operating conditions. First semester.

Messrs. Stewart, Jackson

M.E. 434. Internal Combustion Engines (3)

History; laws of mixing, carburetion, atomization, combustion, and chemical equilibrium; heat losses; friction losses; governing; gas engine cycles; engine types. First semester.

Messrs. Jackson, Eppes

M.E. 435. Internal Combustion Engines (3)

Continuation of M.E. 434. Second semester.

Messrs. Jackson, Eppes

M.E. 436. Gas Turbines and Jet Engines (3)

Theory of the gas turbine; discussion of types and cycles; application to stationary, marine, and aircraft installation; jet-propulsion. Second semester.

Messrs. Eppes, Kreith

M.E. 440. Dynamics of Machinery (3)

Analysis of dynamic loads and the resulting stresses in machinery. Balancing of rotors. Force analysis of internal combustion engines. Dynamics of control mechanisms. First semester.

Mr. Hartman

M.E. 441. Experimental Stress Analysis (3)

The application of certain experimental methods to problems of mechanical design involving static, dynamic and residual stresses. Laboratory use of brittle lacquers, strain gages, photoelasticity and analogies. First semester.

Mr. Hartman

M.E. 442. Advanced Mechanical Vibration Analysis (3)

Systems of more than one degree of freedom, stability, self-induced vibrations, harmonic analysis, alternative theoretical methods, vibration of elastic solids. Second semester.

Mr. Hartman

M.E. 450. Special Topics in Mechanical Engineering (3)

An intensive study of some field of Mechanical Engineering not covered in more general courses. First or second semester. Staff

M.E. 451. Seminar in Mechanical Engineering (1 to 3)

Critical discussion of recent advances in Mechanical Engineering. First or second semester. Staff

METALLURGICAL ENGINEERING

Professors Butts, Stout and Libsch

Assistant Professor Conard

Messrs. Danko, J. H. Gross, Laxar, Lee and Murphy

Met. 1. Introduction to Metallurgy (3)

Preliminary study of materials, apparatus, and types of processes used in the metallurgical industry; fuels and combustion; roasting, smelting, refining; ores, slags; furnaces, refractories, metal working and testing; pyrometry; welding. Lectures, laboratory exercises, plant visits. *Prerequisites: Chem. 5, Phys. 22.* Second semester.

Met. 61. Engineering Metallurgy (2)

An abridgment of Met. 1, 102, 103, especially adapted to the viewpoint of users of metals. *Prerequisites: Chem. 5 or 16; Phys. 12 or 22.* First and second semesters.

Met. 63. Engineering Materials and Processes (3)

A study of engineering properties and materials. Methods and effect of fabrication and treatment. Application and use of materials in engineering. Primarily metals, but including plastics, ceramics, and other engineering materials. *Prerequisites: Chem. 5 or 16; Phys. 12 or 22.* First and second semesters.

Met. 65. Metallurgical Laboratory (1)

Physical metallurgical phenomena associated with the structure and properties of metals and alloys. Metallurgical tools—microscopy, hardness testing, temperature measurement; equilibrium diagrams as related to properties of commercial alloys such as bearing metals; cold deformation and annealing; age hardening; heat treatment of ferrous materials. *Prerequisites: Met. 61 or 63; Phys. 23 and 24.* First semester.

Met. 66. Metallurgical Laboratory (1)

The structure and properties of steel. Hardenability and relation of chemical composition to structure. The relation of structure to tensile strength, yield strength, ductility, toughness, notch sensitivity, fatigue resistance and other design properties; special metallurgical techniques—welding induction hardening, etc. Met. 65 is desirable preparation. *Prerequisites: Met. 61 or 63; Phys. 23 and 24.* Second semester.

Met. 68. Metallurgical Engineering Problems (1)

An abridgment of the problem work of Met. 1 and 112. *Prerequisites:* *Chem. 5, Phys. 22; Met. 1, or 61, or 63 previously or concurrently.* First and second semesters.

Met. 100. Summer Work

At the end of the junior year students in the curriculum of metallurgical engineering are required to secure in industrial plants at least eight weeks practical experience.

Met. 102. Metallurgy of Iron and Steel (3)

Chemical and physical properties of iron and steel; manufacturing processes. Lectures and daily questions, plant visits, and laboratory exercises. *Prerequisites:* *Met. 1, 61, or 63.* First semester.

Met. 103. Nonferrous Metallurgy (3)

Production processes and properties of copper and its alloys, nickel and its alloys, aluminum, magnesium, titanium, tungsten and other nonferrous metals. Lectures and written exercises on textbook assignments. Met. 231 is desirable preparation. A two- or three-day inspection trip (expense about \$20.00) is required. *Prerequisite:* *Met. 1, 61, or 63.* First semester.

Met. 104. Nonferrous Metallurgy (2)

Production processes and properties of lead and its alloys, zinc, gold, silver, mercury, antimony, tin and other nonferrous metals. Met. 231 is desirable preparation. A one-day inspection trip (expense about \$3.00) is required. *Prerequisite:* *Met. 1, 61, or 63. (Met. 103 is not prerequisite.)* Second semester.

Met. 105. Electrochemistry and Electrometallurgy (3)

Lectures, recitations, and laboratory work concerning current and voltage in electrolysis, energy relations, electrode reactions, primary cells and storage batteries, electric furnaces, and practical applications of electricity to metallurgical processes. Desirable preparation: Met. 1, 61, or 63. *Prerequisites:* *Chem. 5, Phys. 24.* First semester.

Met. 112. Problems in Iron and Steel Metallurgy (1)

A course of problems, involving the fundamental principles of the various processes in the metallurgy of iron and steel, to give the student an understanding of the quantitative relationships in the processes. *Prerequisite:* *Met. 102 previously or concurrently.* Second semester.

Met. 191. Thesis in Metallurgy (3)

Candidates for the bachelor's degree in metallurgical engineering may, with the approval of the head of the department, undertake a thesis as a portion of the work during the senior year. First or second semester.

For Advanced Undergraduates and Graduates

Met. 230. Physical Metallurgy (3)

The states of matter; physical structure and constitution of metals; properties as related to atomic structure; X-rays and crystal structure; effect of mechanical working, heat treatment and composition; casting; shaping, welding, and testing metal objects. Lectures, plant visits and laboratory work. *Prerequisites: Met. 1, 61, or 63; Phys. 23 and 24.* First semester.

Mr. Libsch

Met. 231. Metallography (3)

Internal structures of alloys and the constitutional diagram; the relation between structure and properties in industrial alloys; quenching and aging. Lectures, problems, and laboratory experiments. *Prerequisite: Met. 102 and 230.* Second semester.

Mr. Libsch

Met. 308. Electrometallurgy (3)

The practical application of electricity to metallurgical processes; metal finishing; electroplating and electric furnaces. Lectures and laboratory work. *Prerequisite: Met. 105 or consent of instructor.* Second semester.

Mr. Butts

Met. 325. Metallurgical Practice (9)

This course is restricted to a small group of seniors selected by the department from those who apply. Three full days per week are spent at the plant of the Bethlehem Steel Company. Application of metallurgical research methods to full-scale plant operations. Application for admission to this course must be made prior to March 1 of the Junior year. Second semester.

Messrs. Gross, Stout

Met. 338. Metallurgical Colloquium (2)

An opportunity for the student to develop (1) an acquaintance with the current metallurgical literature, (2) the ability to interpret it clearly, and (3) skill in presenting oral engineering reports. *Prerequisites: Met. 105; Met. 103 and 231 previously or concurrently; senior standing in metallurgical engineering.*

Messrs. Libsch and Stout

Met. 352. Advanced Metallurgy of Iron and Steel (3)

Continuation of Met. 102 for seniors and graduate students. Lectures, plant visits, laboratory exercises, written reports. Desirable preparation: Met. 230 and 231. *Prerequisite: Met. 102.* First semester.

Mr. Stout

Met. 358. Industrial Metallurgy (2)

An opportunity for the advanced student to integrate basic metallurgical engineering course material and to apply what he has learned in the solution of problems relating to (1) design and service requirements of metal components, (2) failure of metal components, and (3) selection of materials and processes. Discussion of specific problems to develop approach to

and judgment of engineering problems involving metallurgy. Lectures, problems, and laboratory. It is desirable that the student take Met. 104 previously or concurrently. *Prerequisites:* Met. 103, 105, 231, and 352; M.E. 166. Second semester. Mr. Libsch

Met. 363. Nonferrous Metallurgical Problems (1)

A course of problems concerned with the principles utilized in the metallurgy of copper, aluminum, and other nonferrous metals. Met 68 or 112 is desirable preparation. *Prerequisite:* Met. 103 previously or concurrently. First semester. Mr. Butts

Met. 364. Nonferrous Metallurgical Problems (1)

A course of problems concerned with the principles utilized in the metallurgy of lead, zinc, etc. Met. 363 is desirable preparation. *Prerequisites:* Met. 68 or 112; Met. 104 previously or concurrently. Second semester. Mr. Butts

Met. 375. Elective Projects in Metallurgy (2)

An opportunity for the advanced student to undertake an independent investigation in a metallurgical field of his own choice. Assistance will be given only when the student requests it. The project may be either a comprehensive literature investigation, a theoretical study, or one involving laboratory experiment. The project must receive approval of the department before work is begun. *Prerequisites:* Met. 105; Met. 103 and 231 previously or concurrently; senior standing in metallurgical engineering. First and second semesters. Messrs. Butts, Conard, Libsch, Stout

P.D. 101. Professional Development (1)

Conference hours with the Department staff for the purpose of developing the professional outlook of the engineering student. Required reading, oral reports and term papers. *Prerequisite:* Senior standing. First semester.

P.D. 102. Professional Development (1)

Continuation of P.D. 101, which is not prerequisite. *Prerequisite:* Senior standing. Second semester.

For Graduates

NOTE. Not all of the courses listed below will be given in any one year. Those to be given will be determined by the number of applicants at the beginning of the semester; if the number is less than six, the course may be omitted.

Chem. 334, 335, 344 and 345, Radiation Methods; Chem. 436 and 437, X-ray Research, and Phys. 363, The Physics of Solids may be included in a graduate major in metallurgy.

School of Metallurgical Engineering Practice

Lehigh University, in cooperation with the Bethlehem Steel Company, offers this graduate curriculum. It leads to the degree of Master of Science in Metallurgical Engineering Practice.

In addition to facilities at the University, a field station is maintained in the local plant of the Bethlehem Steel Company.

Work performed at the field station consists essentially of original investigations of a development and plant test nature.

The curriculum consists of twenty-four weeks practice in applying research processes to plant methods in the field station at the Bethlehem Steel Company. Requirements for the degree are completed by fifteen hours of further graduate study at the University.

Admission to the curriculum is limited to ten students. (Not offered in 1955-1956.)

Met. 401. Metallurgical Investigation and Thesis (4-6)

Investigation of some special metallurgical problems, such as an improvement or innovation in some metallurgical process, the establishment of an equilibrium diagram, the effect of heat treatment on a metal or alloy; study of the literature. The study and investigation must be embodied in a written report. *Prerequisite: undergraduate metallurgical courses in the field of the investigation.* First and second semesters.

Messrs. Butts, Conard, Libsch, Stout

Met. 402. Metallurgical Investigation and Thesis (3)

Continuation of Met. 401. First and second semesters.

Messrs. Butts, Conard, Libsch, Stout

Met. 403. Advanced Electrometallurgy (3)

Specialized study in some particular field of electrochemistry or electrometallurgy selected by the student, such as electrode reactions, thermodynamics of electrolysis, electroplating, electrolytic refining, electrothermics, electrothermal efficiencies, industrial processes. *Prerequisite: Met. 105 or the equivalent.* First or second semester.

Mr. Butts

Met. 405. Nonferrous Metallurgy (3)

Study of the metallurgy of any one or more of the nonferrous metals. Comparative properties, extractive processes and mechanical treatments. Reading of references on modern practices, and theoretical consideration of the possibilities of future development in manufacture or use. Both chemical and physical metallurgy of the metals and their alloys may be included. *Prerequisite: a course in nonferrous metallurgy.* First or second semester.

Mr. Butts

Met. 408. Advanced Physical Metallurgy (3)

Advanced study of phase diagrams, diffusion, and phase transformations with emphasis on physical and thermodynamic aspects. Mechanism of deformation and annealing. Dislocation theory. Preferred orientation. Related topics. *Prerequisites:* Met. 230, 231, and 352; Chem. 190; or the equivalent. First or second semester. Messrs. Conard, Libsch

Met. 409. Recent Developments in the Theory of Metals (3)

Current topics and new developments in theoretical physical metallurgy. The topics will vary from year to year. There will be included for example, such subjects as diffusion, magnetism, theories of alloying and equilibrium diagrams, recovery and recrystallization, grain boundaries, dislocations, and internal friction. *Prerequisite:* Met. 408. Second semester. Mr. Conard

Met. 410. The Physical Chemistry of the Metals (3)

The principal fields of physical chemistry in their relation to the extraction of metals from their ores; the refining, alloying, heat treatment, welding, and corrosion of metal systems. *Prerequisites:* one undergraduate course in physical chemistry; elementary ferrous or nonferrous metallurgy or Met. 230 and 231. First or second semester. Mr. Stout

Met. 411. The Principles of Modern Welding (3)

The foundations in scientific principle upon which the welding processes rest; the present limitations of the various processes; the trends in new developments; the engineering, industrial, and commercial aspects of welding. *Prerequisites:* Met. 230 and 231. First or second semester. Mr. Stout

Met. 419. Alloy Steels (3)

The effects of alloying elements on the metallography, heat treatment, and physical properties of steel. Engineering characteristics of constructional, tool, stainless, and other alloy steels. *Prerequisites:* ferrous metallurgy; and previously or concurrently, Met. 230, 231, and 352. First or second semester. Mr. Stout

Met. 421. Surface Treatment of Metals (3)

Study of metallic surfaces, primarily steel; preparation of surfaces by machining, grinding, polishing; methods of surface hardening; corrosion and surface protection of metals; analysis of surface stresses as related to fatigue life. *Prerequisites:* Met. 102, 103, 104, 230, 231 or equivalents. First semester. Mr. Libsch

Met. 423. Powder Metallurgy (3)

A study of the powder metallurgy processes for forming metal parts. Discussion of metal powder production and characteristics, plastic deformation and bonding associated with pressing, the mechanism of sintering,

and the nature of the sintered product; preparation of sintered alloy compacts; application of the process to special industries. *Prerequisites: Met. 102, 103, 104, 230, 231, or equivalents.* First or second semester.

Mr. Libsch

Met. 425. Metallurgical Field Station (15)

This course is restricted to those who are enrolled in the School of Metallurgical Engineering Practice. A period of approximately 24 weeks is spent in the plant of the Bethlehem Steel Company. Application of metallurgical research methods to full scale plant operations.

Messrs. Stout, Gross

MINING ENGINEERING

Professor Gallagher

Assistant Professor Brune

MINING ENGINEERING

Min. 2. Mine Surveying (2)

Methods of underground surveying; note forms; determination of true meridian and latitude; methods of carrying meridian underground through tunnels, slopes, and shafts; problems on mineral land and mine surveying. *Prerequisite: C.E. 40.* Second semester.

Min. 4. Mine Surveying, Field Work (2)

Practice in surface and underground surveying; calculation of field notes; preparation of mine maps. Eight hours of field and laboratory work at an operating mine each week day for two weeks. *Prerequisite: Min. 2, which it must follow immediately.* Summer session.

Min. 100. Industrial Employment

Industrial employment in mining or a related field for eight weeks, usually in the summer following the junior year. A written report is required.

Min. 101. Mining Fundamentals (3)

Methods of prospecting; drilling, explosives, and blasting; tunneling, slope and shaft-sinking; support of workings; machines for cutting and loading. Visits to mines. *Prerequisites: Geol. 1, previously or concurrently; Phys. 24.* First semester.

Min. 161. Mining Engineering (3)

A survey of the elements of mining engineering for students in curricula other than mining engineering. Prospecting, drilling, excavation, support, mining methods, mineral preparation. *Prerequisite: Geol. 1, 4 or 6.* First semester.

For Advanced Undergraduates and Graduates

Min. 202. Methods of Mining (3)

The methods of working bedded and vein deposits, with special attention to principles involved in the selection of a mining method and to mechanization. *Prerequisites:* Mech. 111, previously or concurrently; Min. 101. Second semester. Mr. Brune

Min. 203. Mine Ventilation (3)

A study of mine atmospheres and of gases produced or encountered in mining operations; distribution and control of the ventilating current to meet requirements of safe and efficient operation; mine fires and explosions. *Prerequisites:* Mech. 121, previously or concurrently; Min. 202. First semester. Mr. Brune

Min. 204. Haulage, Hoisting, and Pumping (3)

The fundamentals of basic design, selection, and application of equipment for transportation of mineral products from working face to surface plant; sources, control and disposal of mine water. *Prerequisites:* Min. 202, E.E. 160. Second semester. Mr. Brune

Min. 205. Mining Economics (3)

Systematic exploration and examination; theory and methods of sampling; reserves; mine taxation; depreciation and depletion; valuation and reports. Visits to mines. *Prerequisites:* Acctg. 104, previously or concurrently; Min. 202. First semester. Mr. Gallagher

Min. 206. Mine Administration (2)

Mining law; mine organization and management; wage systems and trade agreements; mine safety organization and regulation; special aspects of workmen's compensation laws; personnel administration. *Prerequisite:* Min. 202. Second semester. Mr. Gallagher

Min. 207. Mineral Preparation (3)

Recovery of minerals from ores; machines and apparatus used for coarse and fine crushing; classifying and preparation for concentration; methods of concentration, including gravity and magnetic methods, flotation, etc.; principles of concentration applied to the preparation of coal. Visits to mills and coal washing plants. *Prerequisites:* Mech. 121, previously or concurrently; Geol. 31, Chem. 38. First semester. Mr. Brune

Min. 252. Fuel Technology (3)

Solid fuels: sampling; proximate and ultimate composition of coals, calorific values, fusibility of ash; classification of coal; carbonization and gasification of fuel. Coal and gas analysis, calorimetry. *Prerequisite:* Chem. 38 or equivalent. Second semester. Mr. Gallagher

Min. 254. Advanced Mineral Preparation (3)

An extension of the study of fundamental theories of mineral preparation begun in Min. 207, with special reference to flotation of metallic and

non-metallic minerals; design of flow sheets based on results of laboratory tests. *Prerequisite:* Min. 207. Second semester. Mr. Brune

For Graduates

Students desiring to do graduate work in mining engineering should consult with the head of the department with regard to their classification.

Min. 411. Mining Research (2-6)

Investigation of a problem in one of the fields of mining engineering: (a) Mining Methods; (b) Mineral Preparation; (c) Mine Ventilation; (d) Mining Economics. First or second semester.

Messrs. Gallagher, Brune

Min. 412. Mining Research (2-6)

A continuation of Min. 411. First or second semester.

Messrs. Gallagher, Brune

Min. 413. Advanced Mining Practice (3-9)

A continuation and amplification of undergraduate work in the major fields of mining engineering. A student may register for one, two or three of the fields in any one semester: (a) Mining Methods; (b) Mineral Preparation; (c) Mine Ventilation; (d) Mining Economics. First or second semester.

Messrs. Gallagher, Brune

Min. 414. Advanced Mining Practice (3-9)

A continuation of Min. 413. First or second semester.

Messrs. Gallagher, Brune

ENGINEERING GEOPHYSICS

For Advanced Undergraduates and Graduates

Eng. Geop. 201. Geophysical Methods (3)

A treatment of the fundamental principles underlying all geophysical methods; elements of theory and physical principles of instruments; physical properties of rocks and formations and methods of their determination. *Prerequisites:* Geol. 1, previously or concurrently; Phys. 24. First semester.

Mr. Gallagher

Eng. Geop. 202. Geophysical Applications (3)

A detailed study of the applications of geophysical prospecting to the fields of mining, geology, and engineering. *Prerequisite:* Eng. Geop. 201. Second semester.

Mr. Gallagher

Eng. Geop. 301. Seismic and Magnetic Prospecting (3)

Seismic: elements of the theory of elastic deformations and wave propagation; a detailed study of the methods (fan shooting, refraction, and reflection); theory and description of seismographs. Magnetic: magnetic properties of rocks and minerals; theory and description of magnetic in-

struments; corrections, representations, and results. *Prerequisites: Eng. Geop. 202, Phys. 212.* First semester. Mr. Gallagher.

Eng. Geop. 302. Electrical and Gravitational Prospecting (3)

Electrical: the fundamental principles of the electrical prospecting methods—self potential, AC and DC equipotential, resistivity, potential-drop ratio, electromagnetic, and radio; the electrical properties of rocks and minerals; theory and description of equipment and interpretation of results. Gravitational: a treatment of the gravitational principles and methods; pendulum, gravimeter, and torsion balance; the theory and description of gravitational instruments; corrections, interpretation, and results. *Prerequisites: Eng. Geop. 202, Phys. 212.* Second semester. Mr. Gallagher

MUSIC

Associate Professor Schempf

Assistant Professor Cutler

Band 1-8. Lehigh University Band (2)

Mus. 11. Introduction to Music (1)

A course designed for students with little or no experience in music, to stimulate intelligent listening and to develop the ability of recognizing the principal styles, forms, and materials. First semester.

Mus. 12. Introduction to Music (1)

Continuation of Mus. 11. Second semester.

Mus. 13. Introduction to Music Literature (3)

A study of the development of music from the Dark Ages to the early nineteenth century, with emphasis on the significant examples of several styles and composers. This course and its continuation, Mus. 14, are designed for students interested in learning the importance of music in Western civilization. Two one-hour periods each week will be devoted to lectures and one two-hour period to supervised listening to recordings and studying available music. The ability to read music will be an asset, but is not required for admission to this course. First semester.

Mus. 14. Introduction to Music Literature (3)

Continuation of Mus. 13. A study of music in the nineteenth and twentieth centuries, including contemporary American music. Second semester.

Mus. 15. The Symphony after Haydn (2)

A study of the representative works for symphony orchestra from Haydn to the present with emphasis on Mozart, Beethoven, Brahms and Schumann. First semester.

Mus. 16. The Age of Handel and Bach (2)

A study and comparison of the instrumental and vocal works of Bach and Handel and their contemporaries. Second semester.

Mus. 17. Basic Musicianship (3)

Review of the fundamentals of music, including keys, clefs, scales, intervals, rhythmic and melodic notation; sight singing, ear training, and composition of melodies with simple harmonization. Emphasis will be placed upon training the ear. *Prerequisite: familiarity with bass and treble clefs.* First semester.

Mus. 18. Basic Musicianship (3)

Continuation of Mus. 17. Development of ability to write and harmonize simple chorale melodies in the style of Johann Sebastian Bach and to write simple two-and three-part forms. *Prerequisite: Mus. 17 or consent of instructor.* Second semester.

Mus. 20. Instrumentation (2)

Study of the instruments of the band and orchestra; practical work in arranging various instrumental combination. *Prerequisite: consent of instructor.* First or second semester.

THE LEHIGH UNIVERSITY BAND

Band may be elected by suitably qualified freshmen and sophomores in place of, or in addition to without credit, military science and tactics. It may be carried as an optional subject by suitably qualified juniors and seniors without credit.

The Band will consist of a marching and concert band and will provide music, as specified by the director for convocations, athletic events, campus and radio programs and military ceremonies; during the latter to be considered an integral part of the R.O.T.C. regiment.

Except during the fall season rehearsals will be twice weekly but, in addition, provisions will be made for sectional rehearsals and individual instruction to be required of all members.

Coat, cap, trousers, and belt of uniform, musical instruments and music are furnished by the University. A deposit of \$25.00 is required from each member of the band for an instrument or uniform.

Students serving in the band receive the following awards: a charm for one year of satisfactory service; for two years of service, a sweater; three years, \$20.00 in cash; and four years, an additional \$20.00 in cash.

PHILOSOPHY

Professor Ziegler

Visiting Associate Professor Pap

Associate Professor Grunbaum*

Assistant Professor Haynes

Phil. 3. Introduction to Philosophy (3)

An introductory survey of the basic problems in the theory of knowledge, explanation, causality and aesthetic theory. These problems are treated in the context of contributions by the major philosophers of the past and present. First and second semesters.

Phil. 14. Logic and Scientific Method (3)

An introductory study of the methods used in clear thinking and in the detection of fallacies. Examination of the principles used in testing scientific hypotheses and in the discovery of causes. Illustrations are drawn from the problems of everyday life. First and second semesters.

* On leave, 1954-55

Phil. 15. Ethics: The Theory of Conduct (3)

A critical comparison of value judgments with judgments of fact; means and ends. The meaning of good, right, and justice; the bearing of ethical theory on the resolution of ideological conflicts. Consideration of the views of the classical thinkers. First and second semesters.

Phil. 100. Philosophy of Contemporary Civilization (3)

A philosophical analysis of the theoretical foundations of our culture, providing a useful method for formulating policies in private and public life. Special attention is given to the nature and integration of ideals of family, industry, education, art, science, law and politics. First and second semesters.

Phil. 151. Philosophy of Art (3)

The meaning of aesthetic terms and the problem of validating aesthetic judgments in the light of past and contemporary philosophies of art. The analysis is carried out in the context of various forms of art such as painting, literature and music. First or second semester.

Phil. 171. Readings in Philosophy (2 or 3)

A course of readings in any of the various fields of philosophy; designed for the student who has a special interest in work not covered by the regularly rostered courses. *Prerequisites: senior standing and consent of instructor.* First semester.

Phil. 172. Readings in Philosophy (2 or 3)

Continuation of Phil. 171. *Prerequisites: senior standing and consent of instructor.* Second semester.

For Advanced Undergraduates and Graduates

Phil. 231. Ancient and Medieval Philosophy (3)

A history of philosophy from the beginnings of scientific and philosophical reflection in Ionia to the Renaissance. Textbook, selected dialogues of Plato, selections from Aristotle, and other collateral reading. First semester. Mr. Ziegler

Phil. 232. Modern Philosophy (3)

An historical treatment of the teachings of the major philosophers from the Renaissance through Hegel, with special reference to Locke, Hume, Descartes, Spinoza, Leibniz and Kant. Textbook; selected readings in the works of the philosophers studied. Second semester. Mr. Ziegler

Phil. 237. Nineteenth Century Philosophy (3)

A study of major philosophers—Hegel, Marx, Schopenhauer, Comte, Spencer and Nietzsche—on central issues of the century such as evolution, theory of knowledge and scientific method, and the philosophy of history. Readings in the works of the philosophers considered. First semester. Mr. Haynes

Phil. 238. Twentieth Century Philosophy (3)

Major contemporary philosophic movements in America and Europe, including pragmatism, logical empiricism, idealism, realism and existentialism. Selected readings from primary and secondary sources. Second semester. Mr. Haynes

Phil. 261. Philosophy of the Natural Sciences (3)

An analysis of the logical structure and significance of modern scientific knowledge. Critical comparison of rival theories of explanation in the physical and biological sciences. The logical structure of the Special Theory of Relativity. Fact, theory, and causality. The nature of mathematical truth and the status of geometry. *Prerequisite: consent of instructor.* First and second semesters. Mr. Grünbaum

Phil. 263. Special Topics in the Philosophy of Physics and Mathematics (3)

Consideration of philosophical issues selected from among the following topics: the theory of relativity, time and entropy, foundations of mechanics, the development of the non-Euclidean geometries, epistemological foundations of quantum theory, the principle of the conservation of energy, and foundations of the theory of probability. Not restricted to majors in physics and mathematics, and may be taken independently of any other philosophy course. *Prerequisite: consent of instructor.* First or second semester. Mr. Grünbaum

Phil. 281. Philosophy of the Social Sciences (3)

A critical analysis of the program of achieving scientific knowledge of man, his development and his culture. Explanatory procedures and predictive power in historical knowledge, the validation of psychoanalytic propositions, and the formulation of methods for analyzing social facts. *Prerequisite: consent of instructor.* First and second semesters. Mr. Ziegler

PHYSICS

Professors Myers, Bayley, C. W. Curtis, and Havas

Associate Professors Cheney, Sawyer, Hyatt, Emrich, and Spatz

Assistant Professors Wheeler, and McLennan

Messrs. Budenstein, Chatelain, Irvine, Costello, Asbridge,

Chivian, Davis, DeVault, Elrick, Fox, Fontheim, Johannes, Kremser,

Muhl, Ridge, Schieve, Smith, Williams, and Woisard

Phys. 12. Introduction to Physics (3)

A survey course of students in the Colleges of Arts and Science and of Business Administration. A brief introduction to principal fields of physics. Lecture demonstrations, recitations, and laboratory. First semester.

Phys. 16. General Physics (3)

A continuation of Phys. 12. Lecture demonstrations and recitations. *Prerequisite: Phys. 12.* Second semester.

Phys. 17. General Physics Laboratory (2)

A laboratory course in general physics to accompany Phys. 16. *Prerequisite: Phys. 16, preferably concurrently.* Second semester.

Phys. 22. Mechanics and Properties of Matter (4)

Introduction to mechanics of solids and fluids; dynamics of point masses and rigid bodies; properties of matter. Two recitations, one lecture, and one laboratory period per week. A knowledge of trigonometry is assumed. First and second semesters.

Phys. 23. Heat, Sound, and Light (4)

Wave-motion and sound; heat, with emphasis on the mechanical theory; optics, with emphasis on those portions of interest to technical students. Two recitations, one lecture, and one laboratory period per week. The calculus is employed in this course. *Prerequisites: Math. 12, Phys. 22.* First and second semesters.

Phys. 24. Electricity and Magnetism (4)

Ohm's law, electric and magnetic fields, electromagnetism, induced electromotive forces, etc. Two recitations, one lecture and one laboratory period per week. The calculus is employed in this course. *Prerequisites: Math. 13, previously or concurrently; Phys. 22.* First and second semesters.

Phys. 100. Industrial Employment

Eight weeks industrial employment during the summer following the junior year, with submission of a written report.

Phys. 110. Electrical Laboratory (1)

Precise measurements. *Prerequisite: Phys. 24.* First semester.

Mr. Bayley

Phys. 111. Electrical Laboratory (1)

Precise measurements. Continuation of Phys. 110. *Prerequisite: Phys. 24.* Second semester. Mr. Bayley

Phys. 171. Physics Proseminar (1)

Discussion of current problems in physics. Intended for seniors majoring in the field. Second semester. Mr. Spatz

Phys. 191. Laboratory Techniques (1)

Laboratory practices and glass blowing. *Prerequisites: Phys. 17 or 23 and 24.*

Phys. 192. Advanced Physics Laboratory (1 or 2)

Laboratory work of research type. Special problems assigned and the student placed largely on his own initiative. Intended for seniors majoring in the field. First semester. Messrs. Bayley, Curtis, Sawyer, Wheeler

Phys. 193. Advanced Physics Laboratory (1 or 2)

Continuation of Phys. 192. Intended for seniors majoring in the field. Second semester. Messrs. Bayley, Curtis, Sawyer, Wheeler

For Advanced Undergraduates and Graduates

Phys. 212. Introductory Theory of Electricity and Magnetism (3)

Magnetic fields and potentials; electrostatic fields, potentials and capacities; electromagnetic fields; variable and alternating current. *Prerequisites: Math. 206, or 219 previously or concurrently, Phys. 16 or 24.* First semester. Mr. Hyatt

Phys. 213. Introductory Theory of Electricity and Magnetism (3)

A continuation of Phys. 212. *Prerequisite: Phys. 212.* Second semester. Mr. Hyatt

Phys. 252. Geometrical and Physical Optics (4)

Geometrical optics and the wave theory of light, interference, diffraction, polarization, etc. One laboratory and three class periods a week. *Prerequisites: Math. 14; Phys. 23 and 24 or 16.* Second semester.

Messrs. Cheney, Curtis

Phys. 268. Introduction to Modern Physical Theories (3)

Recent developments, Maxwell's field equations, photoelectricity, radiation, the quantum theory, X-rays, relativity, atomic and nuclear structure, and cosmic rays. Some training in physics or physical chemistry beyond the elementary level is desirable. *Prerequisites: Math. 14; Phys. 16, or 23 and 24.* First semester. Mr. Spatz

Phys. 269. Introduction to Modern Physical Theories (3)

Continuation of Phys. 268. *Prerequisite: Phys. 268.* Second semester.

Mr. Spatz

Phys. 314. The Physics of Electronics (4)

Electron and ion ballistics, electrons in metals and electron emission, electrical discharge in gases, vacuum tube characteristics and an introduction to electronic circuits. One laboratory, and three class periods a week. Some training in electrical theory beyond the level of general physics is desirable. *Prerequisites: Math. 14; Phys. 16, or 23 and 24.* First semester.

Mr. Wheeler

Phys. 315. Electric Oscillations and Electric Waves (4)

Electric oscillations and waves and high frequency phenomena. One laboratory and three class periods a week. Some knowledge of vacuum tube characteristics and circuit theory is assumed. *Prerequisites: Math. 206, Phys. 16, or 23 and 24.* Second semester.

Mr. Wheeler

Phys. 340. Heat, Thermodynamics, and Pyrometry (4)

Basic principles of heat, thermodynamics, and kinetic theory of gases with emphasis on physical systems, supplemented by practical exercises in the use of thermocouples, resistance thermometers, pyrometers, and similar instruments. One laboratory and three class periods a week. *Prerequisites: Math. 14, Phys. 16 and 17 or Phys. 23 and 24.* First semester

Mr. Emrich

Phys. 362. Spectroscopy (2 or 3)

The interpretation of the findings of modern spectroscopy with particular emphasis on the theory and applications of atomic spectra. The method of obtaining data will be illustrated in laboratory problems. Two class periods per week and one optional laboratory period per week. Students desiring the laboratory work will register for three credits. Some training beyond the elementary level in physics or physical chemistry is desirable. *Prerequisites: Math. 14, Phys. 16 and 17 or Phys. 23 and 24.* Second semester.

Mr. Curtis

Phys. 363. Modern Theory of Solids (3)

Recent developments in the theory of solids with particular reference to the physics of metals. *Prerequisite: Phys. 268.*

Mr. Curtis

Phys. 372. Special Topics in Physics (1-3)

A course covering selected topics not sufficiently covered in the general courses. Lectures and recitations or conferences. *Prerequisites: Math. 14, Phys. 23 and 24 or Phys. 16.* First and second semesters.

Staff

For Graduates

The election of purely graduate courses in physics should ordinarily be preceded by such study of the particular field as that presented in courses in the "200" and "300" groups. A thorough knowledge of the differential and integral calculus is presupposed, and further accompanying study of mathematics is generally advisable.

E.E. 433, 434, 441, and 442, and Mech. 402 may be included in a graduate major in physics.

Phys. 420. Theoretical Physics (3)

The fundamental principles of theoretical physics. The subject matter covered in this course and in Phys. 421, 422, and 423 is that generally considered necessary for more detailed work in special fields. Required of all candidates for the doctorate in physics. First semester. Mr. Emrich

Phys. 421. Theoretical Physics (3)

Continuation of Phys. 420. *Prerequisite: Phys. 420.* Second semester. Mr. Emrich

Phys. 422. Advanced Theoretical Physics (3)

A continuation of Phys. 420 and 421. Required of all candidates for the doctorate. *Prerequisite: Phys. 421 or equivalent.* First semester.

Mr. Havas

Phys. 423. Advanced Theoretical Physics (3)

Continuation of Phys. 422. *Prerequisite: Phys. 422.* Second semester.

Mr. Havas

Phys. 424. Quantum Mechanics (3)

General principles of the present theory; applications to simple problems; perturbation methods; calculation of energy levels and spectral intensities; quantum theory of collision processes and of radiation; nuclear quantum mechanics. First or second semester. Mr. McLennan

Phys. 425. Quantum Mechanics (3)

A continuation of Phys. 424. First or second semester. Mr. Havas

Phys. 428. Methods of Mathematical Physics (3)

The equations of theoretical physics and the methods of their solution. Intended to accompany Phys. 420. First semester. Mr. Wheeler

Phys. 429. Methods of Mathematical Physics (3)

Continuation of Phys. 428. Intended to accompany Phys. 421. Second semester. Mr. Wheeler

Phys. 440. Thermodynamics (3)

A course devoted principally to classical thermodynamics. First semester.

Phys. 441. Kinetic Theory (3)

The classical and quantum considerations of the kinetic theory of gases, and of statistical mechanics, with additional applications to electrical phenomena. Second semester. Mr. McLennan

Phys. 452. Theory of Light (3)

The propagation of light; interference, diffraction; the measurement of wave-length; crystal optics; introduction to quantum theories of the interpretation of spectra. First or second semester.

Phys. 464. Atomic and Molecular Physics (3)

Studies of the extra-nuclear properties of atoms and molecules and the foundations of quantum theory. Mr. McLennan

Phys. 465. Nuclear Physics (3)

Studies of stable and unstable nuclei, fundamental nuclear particles, nuclear reactions, and methods of producing them. Second semester.

Mr. Sawyer

Phys. 467. Nuclear Physics (3)

Continuation of Phys. 465, dealing particularly with nuclear theory. First or second semester.

Phys. 472. Special Topics in Physics (1-3)

Selected topics not sufficiently covered in the more general courses. First or second semester. Staff

Phys. 474. Seminar in Modern Physics (3)

A discussion of important advances in experimental physics. First or second semester.

Phys. 475. Seminar in Modern Physics (3)

A discussion of important advances in theoretical physics. First or second semester. Mr. Havas

Phys. 476. Theory of X-rays (3)

The theory of the production and properties of X-rays; reflection, scattering, and dispersion of X-rays; crystal structure determination; X-ray spectra; ejection of electrons. First or second semester. Mr. Bayley

Phys. 491. Research (3)

Research problems in experimental or theoretical physics. May be repeated for credit. First semester.

Phys. 492. Research (3)

Continuation of Phys. 491. May be repeated for credit. Second semester.

PSYCHOLOGY

Professors Ford and W. L. Jenkins

Associate Professor N. B. Gross

Assistant Professors Small and Millon

Psych. 1. Elementary Psychology (3)

The principles of human behavior and the methods of investigation. A foundation course for all students taking further work in psychology. *Prerequisite: sophomore standing or secondary school background in physics and chemistry.* First and second semesters.

Psych. 12. Introduction to Psychology (3)

A survey course giving brief demonstrations and descriptions of the principal fields of psychology for students who will take but one course in psychology. This course cannot be used as a prerequisite for any other course in psychology. First and second semesters.

Psych. 16. Psychology in Business (3)

Psychological problems involved in advertising and selling; sales personnel; psychology from the standpoint of the consumer. *Prerequisite: Psych. 1.* Second semester.

Psych. 24. Elementary Tests and Measurements (3)

Basic principles of psychological tests; elementary statistics associated with testing. *Prerequisite: Psych. 1.* Second semester.

Psych. 100. Readings in Psychology (2 or 3)

Readings on organized topics selected after consultation with staff members. *Prerequisite: Psych. 1 and consent of instructor.* First and second semesters.

Psych. 111. Minor Research (2 or 3)

Assigned problems for investigation. *Prerequisites: Psych. 1 and consent of head of department.* First and second semesters.

Psych. 112. Minor Research (2 or 3)

Either a continuation of Psych. 111 or a different problem for investigation. *Prerequisite: Psych. 1 and consent of head of department.* First and second semesters.

For Advanced Undergraduates and Graduates

Psych. 304. Social Psychology (3)

A systematic survey of contemporary theoretical positions, methods of investigation, and research relating to the social determinants of behavior. Attitude formation, prejudice, need and perception, national character, and personality in primitive culture. *Prerequisite: Psych. 1.* First semester.

Psych. 308. Child Psychology (3)

Methods of analysis, outstanding research contributions, and contemporary theories concerning the sequential and interrelated patterns of physical and social development. *Prerequisite: Psych. 1.* Second semester.

Psych. 309. Abnormal Psychology (3)

Basic concepts employed in the analysis of behavior disorders. Experimental and clinical evidence concerning the etiology and symptomatology of the major psychopathological syndromes. The more prominent therapeutic techniques are critically evaluated. Lectures and observations at State Hospitals. *Prerequisite: Psych. 1.* Second semester.

Psych. 313. Practice in Applied Psychology (3)

Individual problems and programs involving field applications of psychology will be assigned. The objective will be the development of skills and competence in using psychological materials. *Prerequisites: six hours of psychology and consent of head of department.* First semester.

Psych. 314. Practice in Applied Psychology (3)

Continuation of Psych. 313. *Prerequisites: six hours of psychology and consent of head of department.* Second semester.

Psych. 315. Projective Techniques in Clinical Testing (3)

Instruction in the administration, scoring, and introductory principles of interpretation of the Rorschach technique. Consideration of theory, method, and research relevant to allied techniques such as the TAT, Szondi, and Bender-Gestalt. Each test is examined critically with a view toward improving clinical diagnostics through research. *Prerequisite: Psych. 1.* First semester.

Psych. 316. Individual Testing Techniques (3)

A practicum course designed to evaluate the contributions of each of several diagnostic tests to the clinical assessment of personality and intelligence. Instruction in the administration and interpretation of the Wechsler-Bellevue, WISC, and Binet scales. Two discussion periods and three hours of practice weekly. *Prerequisite: Psych. 1.* Second semester.

Psych. 317. Personality (3)

A review of the development and modification of personality based on an examination of recent clinical, experimental, and anthropological data. Psychosexual development, body-type and personality, defense mechanisms, psychoanalysis, personality measurement, and a critical comparison of the major theoretical approaches and research methods. *Prerequisite: Psych. 1.* First semester.

Psych. 320. History of Psychology (3)

An historical approach to psychological facts, theories, fields, and methods. *Prerequisite: Psych. 1.* First semester.

Psych. 324. Intermediate Tests and Measurements (3)

A study of current research on psychological testing; intermediate psychological statistics. *Prerequisite: Psych. 1.* First semester.

Psych. 327. Group Testing Techniques (3)

Two recitations and three hours of practice in the principal types of group psychological tests. *Prerequisite: Psych. 1.* First semester.

Psych. 329. Physiological Psychology (3)

The physiological basis of psychological processes. Two hours of discussion and two hours of laboratory work per week. *Prerequisite: Psych. 1.* First semester.

Psych. 335. Experimental Psychology (3)

Laboratory work and discussions covering sensory processes, simple reactions, and the more elementary aspects of perception. Two hours of discussion and three hours of laboratory work per week. *Prerequisite: Psych. 1.* First semester.

Psych. 336. Experimental Psychology (3)

Continuation of Psych. 335. Discussions and laboratory work on selected phases of attention, perception, learning, motivation, emotion and higher thought processes. Two hours of discussion and three hours of laboratory work per week. *Prerequisite: Psych. 1.* Second semester.

Psych. 351. Industrial Training and Work Control (3)

The psychology of learning as applied to job training; incentives, labor relations, fatigue, job analysis, and work grading. *Prerequisite: Psych. 1.* First semester.

Psych. 354. Psychological Design Factors (3)

The optimal psychological and physiological factors in instrument and machine design. *Prerequisite: Psych. 1.* Second semester.

For Graduates

Graduate classes will be adjusted to student demand. Seminars and research will be conducted by Messrs. Ford, Gross, Jenkins, Millon, and Small in fields of study appropriate to each staff member. See the Graduate Announcement for admission requirements.

Psych. 403. Seminar in General Psychology (3)

Some significant aspect of psychological theory of principle, but varied from year to year in accordance with student needs.

Psych. 404. Seminar in General Psychology (3)

Either a continuation of Psych. 403. or a new topic.

Psych. 405. Seminar in Applied Psychology (3)

Some significant application of psychology. The topic will vary from year to year in accordance with student needs. *Prerequisite: six hours of psychology in fields related to the chosen topic.*

Psych. 406. Seminar in Applied Psychology (3)

Either a continuation of Psych. 405 or a new topic. *Prerequisite: six hours of psychology in fields related to the chosen topic.*

Psych. 407. Seminar in Clinical Psychology (3)

A systematic review of selected topics in the fields of personality theory, clinical diagnostics, and psychotherapy. First semester.

Psych. 409. Systematic Psychology (3)

A critical approach to the methods, evidence and theories of psychology; the building of an organization of basic principles.

Psych. 410. Systematic Psychology (3)

A continuation of Psych. 409.

Psych. 411. Psychological Research (3)

Assigned problems for investigation on a graduate level. Intended solely for majors in psychology.

Psych. 412. Psychological Research (3)

Either a continuation of Psych. 411 or a new problem.

Psych. 414. Advanced Experimental Psychology (3)

Psychological experiments selected for the graduate level. Two hours of discussion and three hours of laboratory work each week. Second semester.

Psych. 415. Advanced Psychological Measurements (3)

Design of psychological experiments and surveys; advanced psychological statistics. First semester.

RELIGION

Associate Professors Eckardt and Fuessle

Relig. 1. Introduction to Religion (3)

An elementary study covering the following areas: What religion is and does. The place of religion in society. The questions religion answers. Considerable attention to different religious traditions. First and second semesters.

Relig. 6. Old Testament (3)

Study of Old Testament writings, with emphasis on early religious traditions of the Hebrews; the history of Israel from the founding of the Kingdom through the post-exilic period; social, economic and political influences on Jewish religion; the prophetic movement; the Law; the Temple and its worship; and the importance of Jewish religion for Christianity and for mankind. First semester.

Relig. 7. New Testament (3)

Study of New Testament writings, with emphasis on the four Gospels, the Acts of the Apostles and the major Epistles. The life and teachings of Jesus and of St. Paul. The theological viewpoint of the primitive Church as reflected in the New Testament. Second semester.

Relig. 13. Great Living Religions (3)

Consideration of the major ways men around the world have manifested an "ultimate concern." Study of the major faiths of India, the Orient and the Near East. Similarities and differences between Eastern and Western religious traditions. Some attention to recent developments in world religions. First semester.

Relig. 14. Protestantism, Catholicism and Judaism (3)

Analysis of the traditions, beliefs and practices of the major faiths in America today. Some attention to recent trends in church and synagogue. Second semester.

Relig. 16. Persistent Questions in Religion (3)

Consideration of the following questions: Why do we have religion? Can the existence of God be proved? What is faith? Does faith conflict with reason and science? How may religious knowledge and certainty be achieved? What is man? Why do men suffer? Why do men sin? What is prayer? Do miracles happen? Is there a life beyond this one? Second semester.

Relig. 21. The Principles of Christian Ethics (3)

Analysis of the biblical and Judeo-Christian basis for personal and social morality. Emphasis on a creative alternative to cynicism and utopianism, determinism and indeterminism, moral relativism and moral dogmatism. First or second semester.

Relig. 23. The Application of Christian Ethical Principles (3)

Study of the ways in which the basic tenets of our religious tradition may be applied to international relations, competing politico-economic systems, power politics, the race question, interfaith relations and religious toleration, educational and vocational life, and sex and marriage. First or second semester.

RESERVE OFFICERS TRAINING PROGRAM

The Reserve Officers' Training Program at Lehigh University consists of the Army Reserve Officers' Training Corps and the Air Force Reserve Officers' Training Corps. The activities of this program are conducted under the Department of Military Science and Tactics and the Department of Air Science.

A member of the University Administrative Staff, appointed by the President of Lehigh University, serves as Coordinator for the Reserve Officers' Training Program.

By action of the trustees and faculty of the University, the four-semester course of instruction in either Basic Military Science and

Tactics or Air Science is required for graduation with a baccalaureate degree. Normally those students who have served three months or more in any branch of the Armed Forces of the United States are relieved of this requirement and are neither required nor expected to substitute academic work therefore. Eligibility to membership in the Basic Program is limited by law to students who are citizens of the United States between the ages of 14 and 23 years. Upon recommendation of the director of the Student's Health Service, a student may be exempted by reason of physical disability. Members of the University band are relieved from one semester of Basic Program for each semester of satisfactory participation in the band. However this credit cannot be used for entrance into the Advanced Course. Students transferring from other institutions may be exempt from part or all of the required number of hours in the Reserve Officers' Training Program, depending upon the amount of credit allowed at the time of admission. Students pursuing Military or Air Science courses are eligible to be selected for deferment from induction under the Selective Service Law. The number of deferments which may be granted is limited by existing Department of Defense directives.

Qualified students may apply for and be accepted into the Advanced Program, with a commission as Second Lieutenant in the United States Army or Air Force Reserves as the objective. To be eligible for consideration and admission to the advanced program, a student must be a citizen of the United States between the ages of 14 and 25 for Air Force, and between the ages of 14 and 27 for Army, must be of good moral character, must have completed the Basic Course or received credit in lieu thereof and must successfully complete the prescribed physical examination and officer qualification tests. The approval of the respective department head and the President of the University is also required for admission to the advanced program. All students enrolled in the advanced program are required to attend Summer Camp for a period of four to six weeks, normally between the Junior and Senior years.

Students selected for admission to the advanced program are required to sign a written agreement to fulfill certain conditions prescribed by law and regulations. The student, by signing the contract, does not become a member of the Armed Forces of the United States.

Uniforms, textbooks and equipment are furnished by the government to basic students, but each student must provide footwear. Advanced students are furnished textbooks and equipment and given a uniform and subsistence allowance. A cash deposit of \$25.00 is required of all students at the time of registration. The deposit is refunded to the student upon his return of all issued property.

DEPARTMENT OF MILITARY SCIENCE AND TACTICS

Col. Molter

Lt. Cols. Alexander and Simmons

Majors Lambert, Cumbie and Patterson

Captains Simpson, Duggan and Gottschall

Warrant Officer Blackburn

Master Sergeants White, Jones, Walters, Terrell, Heath,
and Cooley

Sergeant First Class Misikevich

An Infantry unit of the Reserve Officers' Training Corps was established at Lehigh University in September 1919, an Ordnance unit in September 1925, and an Engineer unit in September 1947. The military courses are conducted under Department of the Army regulations and consist of two semesters of basic work common to all Army branches, two semesters of basic subjects in branch specialties, and four semesters of advanced work along specialized lines.

For admission to the Advanced Engineer ROTC course, enrollment in an academic course of instruction leading to an engineering, technical or scientific degree is required.

For admission to the Advanced Ordnance ROTC course, enrollment in an academic course of instruction leading to an engineering, technical or scientific degree is required.

Students enrolled in the Advanced Infantry ROTC course are normally selected from among Business and Arts majors.

BASIC COURSES

M.S. 1. Basic Military Science (2)

Fundamental military training common to all branches of the Army to include an understanding of the organization of the Army, an orientation on ROTC, an introduction into the mechanical functioning and employment of individual weapons and marksmanship, an introduction into American military history. Leadership training provided through drill experience together with an indoctrination in military courtesy and customs of the service. First or Fall semester Freshman year.

M.S. 2. Basic Military Science (2)

Continuation of M.S. 1. First or Fall semester Freshman year.

M.S. 3. Basic Military Science (2)

To make the student proficient in the use of maps and aerial photographs, to familiarize the student with all types of Infantry crew-served weapons, to provide him with a knowledge of firepower potential and gunnery principles. Leadership training is continued emphasizing the functions, duties and responsibilities of junior leaders. First or Fall semester Sophomore year.

M.S. 4. Basic Military Science (2)

Continuation of M.S. 3. First or Fall semester Sophomore year.

ADVANCED COURSES

M.S. 101. Advanced Military Science (3)

To develop an understanding of the principles, methods, and techniques which are fundamental to military instruction; to show the student proven practices and devices which tend to make the leader effective; to supply sufficient background information on the various branches of the Army to assist the student in selecting the branch of service he desires; to provide the student with the principles and fundamentals of small unit tactics; to further develop leadership potential by emphasizing the functions, duties and responsibilities of leaders of the first three non-commissioned and/or the junior officer grades. First or Fall semester Junior year.

M.S. 102. Advanced Military Science (3)

Continuation of M.S. 101. First or Fall semester Junior year.

M.S. 103. Advanced Infantry (3)

Advanced military training in Infantry subjects including Organization, Command and Staff, Motors and Transportation, Supply and Evacuation, Troop Movement, New Developments, The Military Team, Tactics— Infantry Battalion in Attack and Defense, Military Administration, Military Law, Military Teaching Methods, Psychological Warfare, Geographic Foundations of National Power, Maps and Aerial Photographs, and Leadership, Drill and Exercise of Command. Four recitations and two hours of drill a week. First semester.

M.S. 104. Advanced Infantry (3)

Continuation of M.S. 103. Four recitations and two hours of drill a week. Second semester.

M.S. 113. Advanced Ordnance (3)

Advanced military training in Ordnance Subjects including Maintenance and Supply, Command and Staff, Military Intelligence, Materiel Specialty, Guided Missiles, Military Administration, Military Law, Military Teaching Methods, Psychological Warfare, Geographical Foundations of National Power, and Leadership, Drill and Exercise of Command. Four recitations and two hours of drill a week. First semester.

M.S. 114. Advanced Ordnance (3)

Continuation of M.S. 113. Four recitations and two hours of drill a week. Second semester.

M.S. 123. Advanced Corps of Engineers (3)

Advanced military training in Corps of Engineers subjects including Reconnaissance and Intelligence, Military Roads and Airfields, Engineers in the Theater of Operations, Barrier Tactics, River Crossing Operations, Amphibious Operations, Construction, Utilities and Job Management, Military Law and Boards, Military Administration, Psychological Warfare, Geographical Foundations of National Power and Leadership, Drill and Exercise of Command. Four recitations and two hours of drill a week. First semester.

M.S. 124. Advanced Corps of Engineers (3)

Continuation of M.S. 123. Four recitations and two hours of drill a week. Second semester.

DEPARTMENT OF AIR SCIENCE

Colonel Earl J. Berryhill

Lt. Colonel Dale E. Altman

Major Donald J. Glenn

Captains Hasek, Naylor, Poston

1st Lieutenants Fredrics, Thomas, Willey

Master Sergeants Howey, Rickenbach, Wilson

Technical Sergeants Crawford, Hale

Staff Sergeants Beagle, Polomski

An Air Force unit of the Reserve Officers' Training Corps was first established at Lehigh University in October, 1946. Upon implementation of the National Defense Act of 1947, the Air Force unit was organized and designated as the Air Force Reserve Officers' Training Corps. The Air Science courses are conducted under

Department of the Air Force directives, and consist of four semesters of basic AFROTC instruction and four semesters of Advanced AFROTC instruction.

Qualified students, regardless of academic field of study, may submit applications for admission into the Advanced AFROTC Course. Successful applicants pursue a generalized AFROTC Course of Study.

Basic AF ROTC Courses

A.S. 1. Freshman Air Science (2)

Introduction to AFROTC; Introduction to Aviation including history and development of military aviation; classes and types of military aircraft; basic principles of flight; propulsion systems; Air Power in modern war, including characteristics and capabilities of military aviation, role of military aviation in war and military aviation in the future and Military Instruments of National Security. Leadership laboratory—Basic military training. First semester.

A.S. 2. Freshman Air Science (2)

Fundamentals of global geography; international tensions and security structures, including a study of factors contributing to modern world power. Leadership laboratory—Basic military training. Second semester.

A.S. 3. Sophomore Air Science (2)

A study of careers in the Air Force; the nature and techniques of aerial warfare; types of targets and air intelligence; conventional weapons, atomic weapons; guided missiles; biological weapons and psychological warfare. Leadership laboratory. First semester.

A.S. 4. Sophomore Air Science (2)

Continuation of A.S. 3. Factors governing the design and types of combat aircraft; problems associated with aerial combat operations, location of Air Bases and Air Base Systems. Leadership laboratory. Prerequisite: A.S. 3. Second semester.

Advanced AF ROTC Courses

A.S. 101. Junior Air Science (3)

The responsibility of command; the organization and functions of an Air Force staff; creative problem-solving; the study of communication media within the Air Force and instructing in the Air Force. Leadership laboratory. First semester.

A.S. 102. Junior Air Science (3)

A study of Military Justice Systems; aerial navigation utilizing dead reckoning, radio and radar; weather as related to aircraft operations; the organization and function of an Air Force Base. Leadership laboratory. Second semester.

ROMANCE LANGUAGES

A.S. 103. Senior Air Science (3)

Critique of Summer Camp; military aviation and the evolution of warfare; principles of leadership and management, including responsibilities and requirements of a leader. Leadership laboratory. First semester.

A.S. 104. Senior Air Science (3)

USAF Career Guidance Program; military aspects of world political geography, including a study of strategic areas and changing patterns of world politics; problems in world security; briefing for commissioned service. Leadership laboratory. Second semester.

ROMANCE LANGUAGES

Professor Barthold

Assistant Professor Farne

Mr. Isar

Mr. Guarino

FRENCH

Fr. 1. Elementary French (3)

Basic French grammar illustrated by oral and written exercises. Attention paid to correct pronunciation of simple spoken French. No previous study of French required. First and second semesters.

Fr. 2. Elementary French (3)

Continuation of Fr. 1, with the addition of the use of simple vocabulary-building texts. *Prerequisite:* Fr. 1. First and second semesters.

Fr. 11. Intermediate French (3)

Reading based on works of the nineteenth and twentieth century writers; formal review of French grammar; prose composition; outside reading. *Prerequisite:* one year of college French or two units of entrance French. First and second semesters.

Fr. 12. Intermediate French (3)

Continuation of Fr. 11. *Prerequisite:* Fr. 11. First and second semesters.

Fr. 13. Types of French Literature (3)

Training in the ability to read and understand representative works from the Middle-Ages to the twentieth century. Conducted in French. *Prerequisites:* Two years of college French or 3 units of entrance French. First semester.

Fr. 14. Types of French Literature (3)

Reading and discussion of representative works of the twentieth century. Outside reading and reports. Conducted in French. *Prerequisites: Two years of college French or 3 units of entrance French.* Second semester.

Fr. 21. Seventeenth Century French Literature (3)

The age of classicism. Lectures, study of texts, collateral readings, and reports. *Prerequisites: Two years of college French or 3 units of entrance French.* First semester.

Fr. 22. Eighteenth Century French Literature (3)

The rise of liberalism as reflected in the writings of Montesquieu, Diderot, Rousseau, and Voltaire. *Prerequisites: Two years of college French or 3 units of entrance French.* Second semester.

Fr. 31. Nineteenth Century French Literature (3)

Main literary currents of the nineteenth century; romanticism and realism: Lectures, reports, collateral readings. *Prerequisites: Two years of college French or 3 units of entrance French.* First semester.

Fr. 32. Nineteenth Century French Literature (3)

Continuation of Fr. 31. *Prerequisite: Fr. 31.* Second semester.

Fr. 41. French Oral and Written Composition (3)

For students who wish a greater opportunity for practice in the oral and written use of French than can be provided in the literature courses. *Prerequisites: Two years of college French or 3 units of entrance French.* First semester.

Fr. 42. French Oral and Written Composition (3)

Continuation of Fr. 41. *Prerequisite: 41.* Second semester.

For Advanced Undergraduates and Graduates

Fr. 221. French Literature before the Seventeenth Century (3)

Survey of French literature from its beginning through the sixteenth century. *Prerequisite: Fr. 42.* First semester. Mr. Barthold

Fr. 222. Contemporary French Literature (3)

Prerequisite: Fr. 42. Second semester. Mr. Farne

Fr. 223. Proseminar (3)

Study of the works of some author or group of authors or of a period. *Prerequisite: Fr. 42.* First semester. Mr. Barthold

Fr. 224. Proseminar (3)

Continuation of Fr. 223. *Prerequisite: Fr. 223.* Second semester. Mr. Farne

ITALIAN

Ital. 1. Elementary Italian (3)

Grammar; composition; rapid reading of easy modern prose. No previous study of Italian required. First semester.

Ital. 2. Elementary Italian (3)

Continuation of Ital. 1. *Prerequisite: Ital. 1.* Second semester.

Ital. 11. Intermediate Italian (3)

The age of Dante. Lectures in English on Dante and his contemporaries; readings in the *Divina Commedia*. *Prerequisite: one year of college Italian or two units of entrance Italian.* First semester.

Ital. 12. Intermediate Italian (3)

The Romantic Period—lectures in English, and selected readings from the works of Manzoni and Leopardi. *Prerequisites: One year of college Italian or 2 units of entrance Italian.* Second semester.

PORTUGUESE

Port. 1. Elementary Portuguese (3)

A study of Portuguese grammar and forms; practice in writing and speaking Portuguese. *Prerequisite: consent of instructor.* First semester.

Port. 2. Elementary Portuguese (3)

Continuation of Port. 1. *Prerequisite: Port. 1.* Second semester.

SPANISH

Span. 1. Elementary Spanish (3)

Basic Spanish grammar illustrated by oral and written exercises. Attention paid to correct pronunciation of simple spoken Spanish. No previous study of Spanish required. First and second semesters.

Span. 2. Elementary Spanish (3)

Continuation of Span. 1, with the addition of the use of simple vocabulary-building and reading texts. *Prerequisite: Span. 1.* First and second semesters.

Span. 11. Intermediate Spanish (3)

Reading of modern Spanish prose, with a view to acquiring exactness and speed in reading; rapid review of grammar with prose composition. *Prerequisite: one year of college Spanish or two units of entrance Spanish.* First and second semesters.

Span. 12. Intermediate Spanish (3)

Continuation of Span. 11. *Prerequisite: Span. 11.* First and second semesters.

Span. 21. Introduction to Spanish Fiction (3)

Readings and discussion of selected novels and short stories; outside reading and reports. Conducted in Spanish. *Prerequisites: Two years of college Spanish or 3 units of entrance Spanish.* First semester.

Span. 22. Introduction to Spanish Drama (3)

Reading and discussion of selected plays; outside reading and reports. *Prerequisite: Two years of college Spanish or 3 units of entrance Spanish.* Second semester.

Span. 31. Spanish Conversation and Composition (3)

For students who wish a greater opportunity for practice in the oral and written use of Spanish than can be provided in the literature courses. Conducted in Spanish. *Prerequisite: Two years of college Spanish or 3 units of entrance Spanish.* First semester.

Span. 32. Spanish Conversation and Composition (3)

Continuation of Span. 31, with special attention given to Latin-American area studies. Conducted in Spanish. *Prerequisite: Span. 31.* Second semester.

For Advanced Undergraduates and Graduates

Span. 221. Spanish Fiction of the Golden Age (3)

The Spanish novel of the sixteenth and seventeenth centuries, with special attention to Cervantes' *Don Quijote*. Lectures, collateral reading, and reports. *Prerequisites: Span. 22 or 32.* First semester.

Span. 222. Spanish Drama of the Golden Age (3)

Selected plays by Lope de Vega, Tirso de Molina, Ruiz de Alarcon and Calderon. Lectures, collateral readings, and reports. *Prerequisites: Span. 22 or 32.* Second semester.

Span. 223. Proseminar (3)

A study of the works of some author or group of authors or of a period. *Prerequisites: Span. 221 or 222.* First semester.

Span. 224. Proseminar (3)

Continuation of Span. 223. *Prerequisite: Span. 223.* Second semester.

Span. 231. Spanish American Literature (3)

Brief survey of the whole field of Spanish American literature, with emphasis on works of modern writers. *Prerequisites: Span. 22 or 32.* First semester.

Span. 232. Spanish American Literature (3)

Continuation of Span. 231. *Prerequisite: Span. 231.* Second semester.

SOCIOLOGY

See Economics and Sociology

Division of Athletics and Physical Education

P. L. Sadler, *Director*

P. E. Short, *Assistant Director and Business Manager*

F. C. Bartlett, *Assistant Director of Physical Education*

The Division consists of the Department of Intercollegiate Athletics and the Department of Physical Education and Intramural Sports. It has supervision over the entire field of intercollegiate athletics and physical education. Its activities consist of intercollegiate athletics, intramural athletics, required physical education, including corrective exercises.

Experience indicates that it is essential that the physical education program emphasize the physical fitness and efficiency benefits to be derived from a well-rounded and athletic phase of the program. The purpose of the athletic, physical education, and intramural sports program is designed to:

- a. Raise and maintain the physical standards of the University.
- b. Develop and maintain a high level of all-around physical fitness so that the undergraduate student may more readily assimilate instruction.
- c. Encourage regular and healthful exercise by the development of skills, techniques, and attitudes.
- d. Foster an aggressive and cooperative team spirit, to increase the confidence of the individual, to develop sportsmanship, and to increase University pride through participation in vigorous competitive athletics.

Facilities for accomplishing this aim and purpose are afforded in Taylor Gymnasium, Grace Hall, the field house, the two playing levels of Taylor Field, and Lehigh Field.

DEPARTMENT OF INTERCOLLEGIATE ATHLETICS

Director Sadler

Assistant Director Short

Messrs. Leckonby, Packer, Whitton, Cooley, Leeman, Christian,
Dockham, Reno, and Havach

The Department of Intercollegiate Athletics offers opportunity to the undergraduate student body to participate in intercollegiate competition both at home and away with institutions which are Lehigh's natural rivals and also other institutions which are at some distance.

The intercollegiate program consists of varsity teams in football, cross country, soccer, wrestling, basketball, swimming, tennis, track, baseball, golf, lacrosse, and fencing, junior varsity teams in football, wrestling, basketball, swimming, and baseball, as well as freshman teams in most of the above sports.

DEPARTMENT OF PHYSICAL EDUCATION AND INTRAMURAL SPORTS

Professor Sadler

Assistant Professors Bartlett, Christian, Dockham, Whitton,
Leeman, and Packer

The Department of Physical Education and Intramural Sports has supervision and control of the required recreational physical activities of the student body. The aim of the department is to insure the health and physical development of every student of the University.

Through its program in physical education and intramural sports the University endeavors to maintain among its students a high degree of physical fitness, to establish habits of regular and healthful exercise, to foster the development of such valuable by-products as self-confidence, good sportsmanship, and a spirit of cooperation, and to provide each student with ample opportunity for acquiring an adequate degree of skill in sports of the type in which participation can be continued after graduation.

Freshman and sophomore students are required to engage in some form of activity under departmental supervision. This requirement calls for three hours a week in the gymnasium or participation in an organized sport. Junior and senior students are encouraged to continue their physical activities and participation in intramural sports.

Prior to his arrival on campus, each new or transfer student must submit to the Health Service a Record of Physical Examination Form filled in and signed by a physician, and a completed

Health History Form. All such Forms are carefully checked by the Health Service and each student thereby classified for activities in the Department of Physical Education in accordance with his current health status.

All freshmen are required to take a physical efficiency test for the purpose of classification and development. Freshman and sophomore students are required to participate in some form of activity under departmental supervision. This requirement calls for three hours a week in the gymnasium or participation, under the supervision of the department, in an organized sport. In the gymnasium, opportunity is offered in the following activities: mass exercises, mass swimming, beginners' swimming, boxing, fencing, apparatus exercises, life-saving, badminton and sports fundamentals. All undergraduate students must swim 75 feet before graduation. Students are encouraged to change their activities whenever it is thought best for their all-around development.

A comprehensive program in intramural sports is sponsored for the student body including fraternity, dormitory, interclass, town, and independent groups in touch football, tennis, soccer, badminton, handball, individual athletics, basketball, swimming, wrestling, track, softball, volleyball, and recreative games. Students are encouraged to participate in these sports, and awards are given for excellence in performance.

Individual exercises are prescribed for the correction of physical and functional defects. Students of this group are carefully examined and individually guided.

The University maintains a well-equipped dispensary for medical treatment. If a student is injured while engaged in any sport he must report as soon as possible to the First-Aid Room or to the Students' Health Service.

The following physical education courses are required of all physically qualified students:

P.E. 1. Physical Education

Freshman first semester. Three hours per week.

P.E. 2. Physical Education

Freshman second semester. Three hours per week.

P.E. 3. Physical Education

Sophomore first semester. Three hours per week.

P.E. 4. Physical Education

Sophomore second semester. Three hours per week.

General Information

General Regulations

Eligibility for Degree

In order to be graduated, a candidate for a baccalaureate degree must achieve a minimum cumulative average of 1.50.

To be eligible for a degree from Lehigh University, a student not only must have completed all of the scholastic requirements for the degree, but also he must have paid all University fees, and in addition all bills for the rental of rooms in the dormitories, or for damage to University property or equipment, or for any other indebtedness to the University. It is understood, however, that this regulation does not apply to any indebtedness for scholarship loans or for loans from trust funds administered by the University which are protected by properly executed notes approved by the treasurer.

Unless exempted by the Faculty for some special reason such as poor health, a student must satisfy all physical education requirements and must complete four semesters of basic R.O.T.C. training, or its approved equivalent, in order to qualify for graduation.

Final Date for Completion of Requirements

For graduation all requirements, scholastic and financial, must have been met by 12 o'clock noon on the Friday preceding the graduation exercises.

Notice of Candidacy for Degree

Candidates for graduation on University Day file with the registrar on or before April 15 a written notice of candidacy for the degree; candidates for graduation in February file a notice of candidacy on or before January 10; candidates for graduation on Founder's Day file a notice of candidacy on or before September 10. Failure to file such notice by the dates mentioned debars the candidate from receiving the degree at the ensuing graduation exercises.

Graduating Theses

Undergraduate theses, when required, are accompanied by drawings and diagrams, whenever the subjects need such illustration.

The originals are kept by the University, as a part of the student's record, for future reference; but copies may be retained by students and may be published, provided permission has first been obtained from the faculty.

Credit and Grades

A semester hour of college work consists of one hour a week of lectures or class work, or two or three hours of laboratory work (or laboratory work combined with class work) a week for one semester. The normal assumption is that the student will be expected to do at least two hours of study in preparation for each hour of class work.

Final grades in courses are A, B, C, D, and F. A, B, C, and D are passing. F indicates failure. Physical education is marked P (passing) or F (failure) without hour credit.

A student who withdraws from a course during the first three weeks of instruction will receive grade of "W." A student who withdraws from a course after the first three weeks of instruction will receive "WF" unless the committee on standing of students, for cause, allows a grade of "W" to be recorded.

The letters "Abs." (absent) are used to indicate absence from a final examination in a course. The grade of "Abs." is reported with a letter grade in parentheses, such letter grade representing the department's estimate of the student's work up to the close of instruction, with the provision that in cases where a department does not feel justified in reporting an estimated grade, a report of "Abs. (X)" will be returned.

The letters "Inc." are used to indicate that the work in a course is incomplete. The grade is accompanied by a letter grade. A student who incurs an "incomplete" in any course and fails to remove the "incomplete" within one calendar year, loses all equity in the course.

HONORS

Honors are of three kinds: class honors, graduation honors, and special graduation honors.

Class Honors

Upon completion of the work of the freshman and sophomore years, on recommendation of the registrar and by vote of the fac-

ulty, class honors are awarded to those individuals who have made an average of 3.00 or better during the preceding year.

The names of these students are announced at the Founder's Day exercises and published in the Founder's Day program.

Graduation Honors

Degrees "with honors" are awarded by vote of the faculty to those students who have attained an average of not less than 3.00 in their last two years' work at the University.

Degrees "with high honors" are awarded by vote of the faculty to those students who have attained an average of not less than 3.50 in their last two years' work at the University.

Degrees "with highest honors" are awarded by vote of the faculty to those students who have attained 3.75 in their last two years' work at the University.

Candidates for graduation who have been in residence at the University for less than two years are not eligible for graduation honors.

Graduation honors are announced at the graduation exercises.

In computing the averages of candidates for graduation honors, semester grades are weighted according to the number of credit hours in the course concerned on the basis: A equals 4, B equals 3, C equals 2, D equals 1, and F equals 0.

Special Honors

Special honors are awarded at the end of the senior year, on recommendation of the head of the department concerned and by vote of the faculty, to students who have done advanced work of unusual merit in some chosen field. Candidates for special honors must indicate to the head of the department concerned and to the registrar during the junior year their intention to work for such honors. Awards are based on grades obtained in the subject chosen, the results in extra work assigned, and the general proficiency of the candidate as evidenced either by a final examination or a thesis, as the head of the department involved may direct. Special honors are announced at the graduation exercises.

Latest Date for Registration

No registration is accepted later than the tenth day of instruction in any semester.

Financial Aid

UNDERGRADUATE SCHOLARSHIPS AND LOANS

General Statement

Lehigh University is desirous of extending tuition aid to deserving and promising students who otherwise would not be able to attend the university, to the extent that funds are available for such assistance. During the academic year 1954-1955, some 475 students were assisted financially to the amount of \$246,000 in loan scholarships and free scholarships.

Scholarship aid is awarded on the bases of established financial need, exceptional academic achievement and promise, commendable participation in activities outside of the classroom, and good citizenship.

Scholarships are awarded on a yearly basis and for an entire scholastic year. Renewal of the scholarship is anticipated upon re-application in the spring of the year. However, continuation of an award assumes that the recipient will continue to show scholastic excellence and leadership activity commensurate with the promise evidenced when the scholarship was originally awarded. Continuing need and good citizenship are also requirements for continuation of awards.

Tuition Scholarship Loans are provided for students who are deserving and in need of aid, but for whom adequate free tuition scholarship aid is not available. The loan may be for a part or, in some instances, for the entire tuition fee, or may be used to supplement a partial free tuition scholarship. However, since the maximum indebtedness which a student is generally permitted to accumulate during his four years is \$1600.00, the loan is as a rule for not more than half the tuition charge in any one semester. Since these loans carry no interest while a student is in college, and are repaid into a revolving loan fund in monthly installments when the student leaves college, this plan enables many worthy and conscientious students to help finance their own way through college by deferment of the payment of part of their tuition. It is often better for a student to take out a partial tuition loan than to spend too many hours in outside work to support himself while in college.

Trustee Scholarships are scholarships covering part, or sometimes all of the tuition charge. These are authorized by the Board of Trustees to be paid from the general funds in order to supplement endowed tuition scholarships.

Leadership Awards, while still requiring evidences of genuine financial need, good scholarship, and good citizenship, place more emphasis on leadership attainments in non-academic activities. The available scholarships of this type include the Alumni Student Grants provided for good students with both aptitude and achievement in athletics; the Music Department Scholarships for students with demonstrated musical talent and ability to perform; and the Leonard Hall Scholarships for students who have evidenced both capacity and deep interest for the Christian ministry, with particular interest in the ministry of the Episcopal Church. These various scholarships are restricted in terms of the particular qualifications and interests of the applicants as indicated in each instance.

Endowed and Supported Scholarships are provided by individuals and by corporations either through endowments or by annual contributions. These scholarships, in many cases provide more than just the tuition, ranging as high as \$1000.00 or \$1500.00 a year in a few cases. Here the emphasis is placed on extraordinary financial need. These awards are intended for the very worthy students who otherwise would not be able to attend college but who are deserving of the opportunity to receive a college education. By dint of earning some money themselves during the summers and, to some extent, during the college year, such students can, with the aid of these scholarships, win a college education. (See page 294 and following.)

ELIGIBILITY.

New Students: Freshmen

Entering freshmen may apply for financial aid in accordance with the information made available in a special announcement which may be obtained from the Office of Admissions.

New Students: Transfers

A student transferring from another four-year college, unless he has been graduated, is not eligible to apply for a tuition scholarship until he has completed one year of residence at Lehigh University.

A student entering from a recognized junior college with full transferred credits (junior standing) may be a candidate for a tuition scholarship on his junior college record.

Students Currently Enrolled

Students who are already enrolled at Lehigh and have been in residence for one college year or more are eligible to apply for any of the tuition scholarships or loan awards.

Veterans

Students entering or returning to Lehigh under the benefits of government subsidies for education as provided by Public Laws 16 or 894; 346, 268, or 550, or similar government subsidies, normally are not eligible for tuition scholarship awards, while attending under government subsidies.

Special financial aid in the form of loans or grants is available to enrolled veterans whose government benefits are inadequate to meet their necessary expenses or who need temporary financial assistance pending receipt of their subsistence checks from the government.

APPLICATION. Candidates for scholarships or loans must make application on forms provided by the committee on scholarships and loans. Candidates not previously enrolled in the University should write for the form to the Office of Admissions; candidates who have been enrolled in the University one academic year or longer should write to the Dean of Students. Dates for filing applications are:

1. For entering freshmen and junior college graduates, first consideration will be given to candidates whose applications are filed before January 15.

2. Before May 30, for sophomores, juniors, or seniors who have been in residence for one or more academic years. It is to a candidate's advantage to send in his application by May 15.

Any application for scholarship aid not conforming to the above procedures can be given consideration only if funds are still available when a late application is received.

All requests must be based on a budget for a full academic year (two semesters).

ACCEPTANCE. All new students to whom scholarships or loans are awarded must signify their acceptance of the award within ten days, at the same time sending in the formal acceptance of admission with the \$50.00 admission deposit, unless this has already been attended to. Awards are automatically withdrawn after ten days if these terms have not been fully met.

TUITION LOANS

Where a student's need for financial aid is not fully met by the free tuition scholarship award granted him, further aid may be granted in the form of a tuition loan to supplement the free tuition award. Under some circumstances, only a tuition loan is granted the applicant.

New students must meet the same minimum qualifications to secure a tuition loan as to receive a tuition scholarship as described above. If an applicant did not receive a free tuition award adequate to cover his tuition needs, the supplementary tuition loan may still enable him to attend Lehigh University. Where it is deserved, this supplementary award generally will be made to the student without further application by him.

For students who have completed two or more semesters in residence at Lehigh, tuition loans are made on the basis of merit and need, at the discretion of the committee on scholarships and loans, and to the extent that loan funds are available.

No loan can be made to a student on scholastic or disciplinary probation. The maximum indebtedness to the University that any student may normally incur is \$1600.00.

The student signs a note for any tuition loan, endorsed by his parent or guardian, agreeing to start repayments within three months from the date of his leaving the University for whatever cause, and at the rate of at least \$25.00 per month until the full amount of the total indebtedness has been repaid.

TIME LIMIT FOR REPAYMENT. Every student incurring indebtedness to the University is required to undertake to pay his debt in full within five years after his graduation or withdrawal, according to a schedule to be agreed upon. In cases involving the maximum debt of \$1600.00, the payment of the principal, at the rate of at least \$25.00 per month, should be completed within four years and eight months. All payments are applied first to the reduction of the principal of the debt.

INTEREST ON TUITION LOANS. Indebtedness incurred through tuition loans bears no interest so long as the student is in residence. From the date of graduation or withdrawal, such indebtedness bears interest at the rate of 3% for the first and second years, 4% the third and fourth years, and 5% thereafter.

ENDOWMENT OF SCHOLARSHIP

Undergraduate or graduate scholarships named to honor an individual or corporation may be established in perpetuity by arrangement with the board of trustees of Lehigh University. The income from this donation will be paid to the holder of the scholarship to be applied toward the payment of University fees. The University does not, however, guarantee that this income will be forever sufficient to pay such fees in full.

DESCRIPTIONS OF ENDOWED SCHOLARSHIPS

The Ray Sands Nostrand Memorial Scholarship

The Ray Sands Nostrand Memorial Scholarship was established by the late Benjamin Nostrand, Jr., M.E. '78, in memory of his son, Ray Sands Nostrand, '17. The income from this fund is awarded to students of the University. The requirements governing the awards of University scholarships apply likewise to this scholarship.

The Fred. Mercur Memorial Fund Scholarship

Friends of the late Frederick Mercur, of Wilkes-Barre, Pa., General Manager of the Lehigh Valley Coal Company, desiring to establish a memorial of their friendship and esteem, and to perpetuate his memory, contributed and placed in the hands of the trustees of the University a fund called the Fred. Mercur Memorial Fund. The income from this fund is awarded to students of the University. The requirements governing the award of University scholarships apply likewise to this scholarship.

The Henry S. Haines Memorial Scholarship

Mrs. Henry S. Haines, of Savannah, Ga., established in 1889 a scholarship of the annual value of \$100.00 as a memorial to her son, Henry Stevens Haines, M.E., '87. By the terms of the bequest

this scholarship is awarded to a student in the curriculum in mechanical engineering. The requirements governing the award of University scholarships apply likewise to this scholarship.

The Mansfield Merriman Scholarship Fund

This fund was established under the will of Bazena T. D. Merri- man to provide a scholarship in Civil Engineering in memory of her husband. Dr. Merriman served as Professor of Civil Engineer- ing at Lehigh University from 1878 to 1907, during which time his textbooks were widely adopted by engineering schools in the country and translated into many foreign languages.

The William S. Cortright Memorial Scholarship

Mrs. William S. Cortright established in 1938 a fund, the in- come from which provides a scholarship annually in memory of her husband, who graduated from Lehigh University in 1872. By the terms of the bequest this money is to be used for the main- tenance of a part-tuition scholarship, to be awarded to a student who is a resident of Bethlehem or the immediate vicinity and who is enrolled in the curriculum of mechanical engineering. The award is to be made by the committee on scholarships and loans under the regular requirements governing the award of other University scholarships.

The Natt Morrill Emery Scholarship

Established in memory of the late Natt Morrill Emery, vice- president and controller of Lehigh University, by an alumnus and former student of Dr. Emery's, the Natt Morrill Emery Scholar- ship covers the full tuition fee. It will be awarded by Lehigh Uni- versity every four years (or whenever it becomes vacant) to that graduate of the high schools of Richmond, Virginia, selected by the Richmond school authorities, who during his scholastic career has exemplified in character and conduct the qualities of loyalty and ability which marked the services of Dr. Emery to Lehigh Uni- versity.

The Murtha P. Quinn Scholarship

Mr. Murtha P. Quinn left one-thirtieth of his residual estate to Lehigh University for the purpose of establishing a free tuition scholarship in the amount of \$400.00 annually. Preference is to be given to students whose homes are in South Bethlehem.

The Henry Kemmerling Memorial Scholarships

Three scholarships, provided through the gifts of Henry Kemmerling of the class of 1891, are to be awarded, one each year, to graduates of the public senior high schools of Scranton, Pennsylvania, of which there are now two, viz: Central High School and Technical High School. The scholarship is to cover the tuition fee of the holder thereof.

A scholarship award is to be renewed yearly to the initial holder thereof until he graduates, provided he remains in school and maintains a grade at least equal to the average of his class during the preceding year.

The following qualifications only are to be the basis of the award of the scholarships: (a) a good character; (b) need of financial assistance; (c) high scholastic ability. The awarding of these scholarships will be administered through the committee on scholarships and loans.

At the discretion of the president, each full scholarship may be divided into two or more partial scholarships so that two or more may benefit by any annual award.

If at any time the income from the funds should warrant, two scholarships may be awarded in one year. If at any time the accumulated income is not sufficient to pay the full amount of the tuition fee, the scholarship shall be awarded nevertheless, the balance being taken from the principal of the fund.

The Luther Rees Zollinger Memorial Fund

The sister of Luther Rees Zollinger left the residue of her estate to Lehigh University to establish this memorial fund to provide tuition scholarships for worthy students who are in need of financial assistance. The awards are to be made by the committee on scholarships and loans, under the regular requirements governing the award of other University scholarships.

The Samuel Foster York Memorial Scholarship Fund

This fund was established by Warren W. York, of the Class of 1924, as a memorial to his father, Samuel Foster York. The income is to be applied towards tuition scholarships for needy and worthy graduates of Allentown, Pennsylvania, secondary schools

who desire to pursue business administration courses at Lehigh University. The award is to be made by the committee on scholarships and loans under the regular requirements governing the award of other University scholarships.

The Theophil H. Mueller Class of 1918 Scholarship Fund

This fund was established by Theophil H. Mueller, a corporate trustee of the University. The income is to be used to assist in defraying the expenses of some worthy student or students who are in need of financial assistance, provided, however, that if it is possible and advisable the student or students selected to receive such financial assistance shall be of the Moravian faith and preferably from Bethlehem, Pennsylvania, or its environs. Awards are to be made by the committee on scholarships and loans, under the regular requirements governing the awarding of other University scholarships.

The John R. W. Davis Memorial Scholarship Fund

This fund was established by Mrs. John R. W. Davis of Seattle, Washington, in memory of her husband, John R. W. Davis, C.E., Class of 1891. The income is to provide for scholarships in civil engineering for meritorious students in need of financial assistance. Awards are to be made by the committee on scholarships and loans, under the regular requirements governing the awarding of other University scholarships.

The Alfred R. Glancy Fund

General Alfred R. Glancy of the Class of 1903 established this fund in 1949. The income provides for undergraduate scholarship awards made by the Committee on Scholarships and Loans, in addition to the Alfred Noble Robinson Award of \$1,000 annually to a selected Faculty member in memory of General Glancy's grandfather.

The Jacob B. Krause Scholarship Foundation

The Jacob B. Krause Scholarship Foundation was established under the will of Jacob B. Krause, Class of 1898, for the purpose of assisting needy students in the College of Arts and Science. Scholarships are to be awarded only to male students who maintain good scholastic standing and are in need of financial help. The

awards are to be made by the committee on scholarships and loans under the regular requirements governing the award of other university scholarships.

Isadore Raiff Memorial Fund Scholarship

The fund was established by the Rayless Department Stores, New York City, in honor and in memory of their late President, Isadore Raiff. The income from the fund is to be used to award a scholarship to worthy students in the College of Business Administration. Preference will be given to candidates from the states of Georgia, New York, North Carolina, South Carolina, Tennessee, and Virginia. The award is to be made by the Committee on Scholarships and Loans under the regular requirements governing the award of other university scholarships.

The David R. Thomas Memorial Fund

This fund was established by Professor and Mrs. Harold P. Thomas after their son's death in a plane crash on South Mountain in June, 1950. Donations from friends and family have been included in the fund. The income is to be used for tuition scholarships for one or more students who have completed at least one year at Lehigh University and are in need of financial assistance to complete their education. The award or awards will be made to students who exemplify in their lives the high ideals which were characteristic of David up to his untimely death.

The Bethlehem Fabricators' Scholarship Fund

This fund was established by Bethlehem Fabricators, Incorporated to provide tuition scholarships for students who are in need of assistance. Character and personality, high scholastic achievement and leadership qualities shall be given consideration when these awards are made. Other qualifications being equal, preference shall be given to candidates applying from the Counties of Lehigh or Northampton in Pennsylvania.

The J. D. Berg Scholarship Fund

This fund was established by Mrs. J. D. Berg in memory of John Daniel Berg, M.E. '05, who devoted many years to Lehigh University as Alumnus and as Trustee. An annual scholarship of \$1000 shall be awarded to a student who is in financial need and

has prerequisites of character and personality, high scholastic achievement and leadership qualities which merit the award. Preference shall be given to students residing in the West Pennsylvania District and who enroll in an Engineering Curriculum at Lehigh University.

The Bernard H. Jacobson Fund

This fund was established by Mr. Bernard H. Jacobson, a graduate from Lehigh University in Electro-Metallurgy, in the Class of 1917. The income is to be used to provide financial aid, usually to the amount of the tuition, for one or more students as the income may provide, who shall show financial need, good character and personality, high scholastic achievement and qualities of leadership.

The Granite City Steel Company Scholarship Fund

The Granite City Steel Company, Granite City, Illinois, established this fund in 1951. The income provides annual awards for undergraduates in the College of Engineering, on the basis of financial need, character and personality, scholastic achievement and leadership qualities.

The William W. Coleman Fund

William W. Coleman, alumnus of the Class of 1895, established this fund in 1951. The income provides annual awards in general equal to the amount of tuition, for undergraduates, preferably seniors in metallurgical engineering, on the basis of financial need, high scholastic achievement, character, personality, and leadership qualities.

York-Shipley Fund

This fund was established by York-Shipley Inc. of York, Pa., through its president, S. H. Shipley, Class of 1922. The income is to be used to provide scholarships to worthy students in need of financial assistance enrolling in the College of Engineering, with preference being given to students from the County of York in Pennsylvania enrolling in the Mechanical Engineering curriculum.

The Harvey M. Burkey Scholarship Fund

Endowed by the American Metals Company, Limited

The American Metals Company, Limited established this fund in 1951. The income provides annual awards to be granted to

students seeking a bachelor degree in Mining, Metallurgical or Chemical Engineering, on the basis of character, scholarship and the qualities which give promise of leadership.

The Rust Engineering Company Fund

The Rust Engineering Company established this fund in memory of two of its co-founders, E. M. Rust, and E. J. Lee Rust, for the purpose of awarding scholarships to students of the engineering college of Lehigh University on the basis of financial need, character and well adjusted personality, intelligence, and above average potential for leadership.

The John T. Fuller Memorial Fund

This fund was established by Esther Fuller Warwick in memory of her father, John T. Fuller, Class of 1903. The income from the fund is to be used to provide scholarships in the school of Mining Engineering which are to be awarded to deserving Pennsylvania boys working their way through Lehigh University.

The Lehigh Portland Cement Company Scholarship Fund

The Lehigh Portland Cement Company established this fund in 1952. The income from the fund is to be used for the purpose of awarding scholarships to undergraduate students on the basis of financial need, character and well adjusted personality, intelligence, and above average potential for leadership.

Award of Bethlehem Fabricators, Inc.

Bethlehem Fabricators Inc. have established a scholarship fund in honor of Ralph Parke Hutchinson, Class of 1904 at Lehigh University and in recognition of his forty years of service to the company and his devotion to his alma mater. It is hoped that these incentive scholarship awards from this fund will serve "to spread and implement his belief in the American tradition of private industrial development and his interest in the education of worthy young men to carry forward that tradition." This scholarship will be awarded annually to the senior engineering student who "has shown the most improvement during his sophomore and junior years," and under the rules of the Committee on Scholarships and Loans.

Atlas Equipment Corporation Scholarship Fund

Through its president, Paul B. Reinhold, alumnus of the Class of 1913, the Atlas Equipment Corporation of Pittsburgh, Pennsylvania, has established this scholarship fund. The income from the Atlas Equipment Corporation Fund is used to provide scholarships covering tuition in such amounts as student need indicates, on the basis of character, intelligence, and leadership qualities.

The Treadwell Engineering Company Scholarship

The Treadwell Engineering Company of Easton, Pennsylvania, has established at Lehigh University The Treadwell Engineering Company Scholarship Fund to support annual tuition scholarships in such number and amounts as income will support. The scholarships are for students in mechanical engineering, with preference given to candidates from Lehigh and Northampton Counties in the State of Pennsylvania. The awards are made by the university Committee on Scholarships and Loans under the established rules governing the award of university scholarships.

The Hammonton High School Scholarship

Leon T. Mart, alumnus of the Class of 1913, and president of The Marley Company of Kansas City, Kansas, established this scholarship fund in 1953 for the benefit of his high school and university. The income from the Hammonton Scholarship Fund is to support one continuous tuition scholarship in the College of Engineering at Lehigh University for a graduate of Hammonton High School, Hammonton, New Jersey. The Hammonton High School shall recommend candidates for this scholarship and the university Committee on Scholarships and Loans is to make the award under the established rules governing the award of university scholarships.

Donald B. Stabler Scholarship Fund

Donald B. Stabler, an alumnus of the Class of 1930, established this fund in 1953. The fund is to be used to provide full tuition scholarships on the basis of character, intelligence, leadership qualities, and financial need. All factors being equal, preference is to be given first to candidates for the Civil Engineering curriculum; and secondly, to candidates for the other engineering curriculas.

Class of '04 Scholarship Fund

Members of the Class of '04, on the occasion of their Golden Anniversary in June '54, established this scholarship fund as a memorial to the class. The income from the fund is to be used to award a senior scholarship on the basis of character, scholarship, qualifications indicating promise of future leadership, and extra-curricular activities. Financial need is not to be requisite for the award.

The Alban and Eleanor Eavenson Scholarship Fund

This fund was established by Alban Eavenson, Class of '99, as an expression of his interest in helping young men obtain a Lehigh education. The income from the fund is to be used to award scholarships with preference to students enrolled in either the chemistry or chemical engineering curriculum.

Alvin Macauley Scholarship Fund

This fund was established by Mrs. Alvin Macauley in honor of her husband, Alvin Macauley, Class of '92, who was Chairman of the Board of the Packard Motor Car Company. The income from this fund is to be used to award scholarships to worthy students in need of financial assistance.

Frederick C. Seeman, Jr., Scholarship Fund

This scholarship fund was established by a bequest from Aringdale D. Seeman of Baltimore, Maryland, in memory of his son, Frederick C. Seeman, Jr., a member of the Class of '27, who was killed in an automobile accident in 1927. Income from the fund is to be used to award scholarships to worthy students from the State of Maryland who are in need of financial assistance.

DESCRIPTION OF SUPPORTED SCHOLARSHIPS

Air Products, Incorporated Scholarships

Air Products, Incorporated of Emmaus, Pennsylvania, desiring to make it possible for deserving young men needing full scholarship assistance to obtain an engineering education, has established two \$1500 scholarship awards at Lehigh University. It is the hope of the Company that these scholarships will help solve the present shortage of engineering graduates, thereby benefiting both industry and the young men of the country.

The Allied Chemicals National Aniline Scholarship

The National Aniline Division of the Allied Chemical and Dye Corporation supports a \$900 scholarship at Lehigh University for students in Chemistry or Chemical Engineering. The award is to be made by the Committee on Scholarships and Loans under the established rules governing the award of university scholarships.

American Cyanamid Company Scholarship

This scholarship was established by the American Cyanamid Company to support the training of undergraduate students working for the bachelor's degree in chemistry and chemical engineering. The scholarship is to be alternated year by year between the Departments of Chemistry and Chemical Engineering. A recipient will be chosen from among students about to enter either their junior or senior year. The scholarship recipient will receive a stipend of \$600 per year and the University will receive an amount of \$300 for use of the Department of Chemistry or Chemical Engineering.

The American Society for Metals Foundation for Education and Research Scholarship

The American Society for Metals Foundation for Education and Research offers annually an undergraduate scholarship of \$400. The scholarship is awarded on recommendation of the Head of the Department of Metallurgical Engineering and approval of the Committee on Scholarships and Loans, to a student entering his Sophomore or Junior year in that curriculum. High scholastic ability and financial need are considered in making the award.

The American Viscose Scholarship

The American Viscose Corporation of Philadelphia supports an annual award at Lehigh University of \$500 for a junior-year student in chemistry or chemical engineering. The award will be renewed for the student's senior year provided his scholarship is satisfactory. The University Committee on Scholarships and Loans makes the award under the established rules governing the award of university scholarships, but subject to the approval of the College Relations Committee of the American Viscose Corporation.

**The Archer-Daniels-Midland Senior Award in Chemistry
or Chemical Engineering**

This scholarship was established by the Archer-Daniels-Midland Company to assist worthy and competent students in the curriculum of Chemistry or Chemical Engineering to complete their senior year. The scholarship is awarded on the basis of excellent character, a well balanced personality, and financial need. The recipient must be in the upper half of his class academically.

Armstrong Cork Company Scholarship

The Armstrong Cork Company Scholarship will be awarded to a freshman with no restriction as to curriculum choice. Each scholarship will cover the cost of tuition, required fees and books for a full school year and will amount to a maximum of \$1,000 per school year. The company will also provide a "cost-of-education" grant of \$500 a year to the University.

Bethlehem Globe-Times Scholarship Fund

The Globe- Times Foundation, Incorporated, has established at Lehigh University a full tuition scholarship to be awarded to a candidate for admission to any one of the three colleges of the University, who resides within the circulation area of the Globe-Times. Where such factors as financial need, character, personality, and scholastic achievement are equal, preference shall be given to candidates employed by the Bethlehem Globe-Times Publishing Company or whose parents are employed by the Company.

The Black and Decker Manufacturing Company Scholarship

The Black and Decker Manufacturing Company scholarship is to be awarded to a freshman who is planning to major in either the mechanical, electrical or industrial engineering curriculum. The recipient must be a resident of the State of Maryland. Other qualifications being equal, preference is to be given to a graduate from Baltimore Polytechnical Institute, Baltimore, Maryland. Also preference is to be given to the son of a Black and Decker employee. The amount of the scholarship is \$940 per year.

Blaw-Knox Company Scholarship

The Blaw-Knox Scholarship will be awarded to the son of a regular employee of the company. It will include an award to the

recipient of \$1,250 a year together with a grant-in-aid to the University of \$250 a year.

The Byron Scholarships

Through the president, Byron Roudabush, alumnus of the Class of 1929, Byron, Incorporated, Motion Pictures Studio and Laboratory in Washington, D. C., supports scholarships at Lehigh University for \$1000 to be awarded to a junior in chemistry, chemical engineering, mechanical engineering or engineering physics, with the expectation that the student will receive the award in his senior year also, provided his scholastic work continues satisfactory. A student membership is also granted the recipient, in the Society of Motion Picture and Television Engineers, with which Society the Byron Corporation joins to encourage trained engineers to enter the industry. The award is made by the university Committee on Scholarships and Loans under the established rules governing the award of university scholarships.

The Edward Campbell Company Scholarship

The Edward Campbell Company of Vineland, New Jersey, supports a \$400 scholarship to encourage graduates of the Vineland High Schools to attend Lehigh University. The award is to be made by the University Committee on Scholarships and Loans under the established rules governing the award of university scholarships.

The Clevite Scholarships

The Clevite Corporations of Cleveland, Ohio, through its Clevite Foundation, supports at Lehigh University scholarship awards for two or more senior engineers, to a total of \$500.00 annually. These awards are for seniors in chemistry (either electro-chemistry or inorganic) metallurgy (non-ferrous), mechanical engineering, or physics (preferably electronics). The awards are made by the university Committee on Scholarships and Loans under the established rules governing the award of university scholarships.

The Dravo Corporation Scholarships

The Dravo Corporation of Pittsburgh, Pennsylvania, supports at Lehigh University, an annual scholarship award of \$1000 for

a junior engineering student in civil, electrical or mechanical engineering. The recipient of the award will receive a renewal of this Scholarship in his senior year if his scholastic work continues to be satisfactory. The awards are made by the university Committee on Scholarships and Loans under the established rules governing the award of university scholarships, by submitting recommendations of students to the Dravo Corporation, from which nominees the Corporation selects the recipient.

Flexonics Corporation Scholarships

The Flexonics Corporation has provided two \$500 Scholarships to be given to seniors. The awards are made by the University's Committee on Scholarships under the established rule governing the award of University scholarships.

Fort Pitt Bridge Works Scholarships

The Fort Pitt Bridge Works Scholarship is to be awarded to a junior enrolled in the civil engineering curriculum who will major in the structural option. The award will be in the amount of \$1,000 a year. Also in recognition of the fact that tuition does not cover the full cost of education of the student, the company will make an unrestricted gift to the University of \$250 each year.

General Motors

The General Motors Corporation in its program of aiding private colleges has made available to Lehigh University several undergraduate scholarships. These scholarships will range up to \$2,000 annually depending upon "demonstrated need." In addition the University will receive a grant-in-aid equivalent on the average to some \$500 to \$800 annually per student.

Golden Gate Scholarship

The mother of a recent graduate from Lehigh University expresses her appreciation to the institution by making an annual contribution of \$300 to be used as a partial tuition scholarship for a student of undoubted loyalty to his country, and who is in need of financial assistance in order to complete his course at Lehigh University. The scholarship will be awarded by the Committee on Scholarships and Loans under the same rules as apply to other scholarships.

Interchemical Corporation Scholarships

The Interchemical Corporation will provide \$1,000 a year to be awarded to either juniors or seniors in the chemistry, chemical engineering and engineering physics curricula. The number of awards will be from two or four each year and accordingly, the stipend will vary from \$250 to \$500.

The Kift-Mullen Memorial Foundation Scholarship

The Kift-Mullen Memorial Foundation of Allentown, Pennsylvania, makes available to graduates of Allentown high schools four annual scholarships of \$200, to students of junior standing in various teacher training institutions, who are preparing to enter the secondary school teaching profession. The university Committee on Scholarships and Loans makes recommendations of qualified Lehigh University students to the Kift-Mullen Memorial Foundation, which passes such recommendations from various teacher training institutions on to a committee of the Allentown high schools' representatives who make the final selection.

Lehigh Valley Supply Company Scholarship

The Lehigh Valley Supply Company of Allentown, Pennsylvania, has annually provided a part tuition scholarship in the amount of \$500. In general, this award is to be used for either a Junior or Senior who must have financial assistance in order to complete his course at Lehigh University. The scholarship will be awarded by the Committee on Scholarships and Loans, under the same rules as apply to other scholarships.

Milton Roy Sheen Memorial Scholarship

Through its president, Robert T. Sheen, Lehigh Class of '31, the Milton Roy Company of Philadelphia, Pennsylvania, has established a scholarship as a memorial to the founder of the company, Milton Roy Sheen. The Milton Roy Sheen Memorial Scholarship provides an annual award of \$1200. The scholarship is to be awarded to employees, or sons of employees of the Milton Roy Company. If no candidates are available, the scholarship is to be awarded to either a Junior or Senior enrolled in the Mechanical or Electrical Engineering curriculum.

Modern Transfer Company Scholarship

The Modern Transfer Company of Allentown, Pennsylvania,

through its President, Samuel L. Lebovitz, a graduate of the Class of 1923, has established a \$1000 a year scholarship at the University. The scholarship is awarded on the basis of high intelligence, financial need, and the qualities that give promise of leadership.

Philco Corporation Scholarships

In recognition of industry's need for more engineers, the Philco Corporation has established four engineering scholarships at Lehigh University. The Philco scholarships provide a stipend of \$1500 apiece. It is intended that these awards will be made to candidates who, because of financial need would not otherwise be able to undertake a college education.

Republic Steel Corporation Scholarships

In recognition of the need on the part of industry for more trained engineers, the Republic Steel Corporation has established at Lehigh University five scholarships providing a yearly award of \$1400 apiece. The Republic Steel Scholarships are to be awarded to candidates for admission to the Engineering College on the basis of character, intelligence, leadership qualities, and financial need, with special attention being given to the latter.

The George Sall Metals Company Scholarship

The George Sall Metals Company Scholarship will be awarded to a freshman by the University's Committee on Scholarships on recommendations submitted by the Golden Slipper Square Club of Philadelphia. The scholarship will be in the amount of \$1,000 a year. Also the company will make an annual grant-in-aid to the University of \$250 each year.

The Trane Scholarship

The Trane Scholarship will be awarded to a student for a senior year of study in the mechanical engineering curriculum. An exception can be made and an award can be given to a junior if, in the opinion of the University, he is especially deserving. The amount of the scholarship is \$1,000.

The Union Carbide and Carbon Scholarships

The Union Carbide and Carbon Corporation, through the Union

Carbide Educational Fund, has established at Lehigh University sixteen annual scholarships at \$900 each, four to be awarded each year for four-year periods, to assist deserving students interested in a business or industrial career. The awards are to be made by the university Committee on Scholarships and Loans under the established rules governing the award of university scholarships.

John H. Ware, Jr., Scholarship Fund

John H. Ware Jr. scholarships will be awarded by the University's Committee on Scholarships for a needy and worthy student. Scholastic attainment is not a primary requirement in benefiting from this fund.

DESCRIPTION OF LOAN FUNDS

The Eckley B. Coxe, Memorial Fund

In memory of the late Eckley B. Coxe, trustee of the University, Mrs. Coxe established a fund, amounting to \$70,000.00, the interest of which is used, under the direction of the trustees of the University and subject to such regulations as they may adopt, for the assistance of worthy students requiring financial aid.

The Frank Williams Fund

Frank Williams, B.S. '87, E.M. '88, who died in October, 1900, bequeathed to the University the greater part of his estate to found a fund, now amounting to \$245,000.00, the income of which is loaned to deserving students.

The Frazier and Ringer Memorial Fund

The Frazier and Ringer Memorial Fund was established in 1906 by the late Robert H. Sayre, in memory of Benjamin West Frazier, A.M., Sc.D., former professor of mineralogy and metallurgy, and Severin Ringer, U.J.D., former professor of modern languages and literature and of history, each of whom served Lehigh University for one-third of a century. The income from the fund and payments made by former borrowers are available for loans to cover the medical and surgical care of worthy students.

The President's Fund

The President's Fund was established during the early years of the University for the help of deserving students. As payments are made by former beneficiaries, they are immediately available for the assistance of students of the University.

The Kenneth Hankinson, Jr. Memorial Fund

Mr. and Mrs. Kenneth Hankinson, established this Fund in memory of their late son who graduated from the College of Business Administration in the Class of 1950. The principal from this Fund shall be used to grant emergency loans to deserving students of Lehigh University. Administration of the Fund is at the discretion of the dean of students of the University.

GRADUATE SCHOLARSHIPS AND FELLOWSHIPS

University Scholarships and Graduate Tuition Grants

The Board of Trustees has authorized the annual award, to graduate students, on the basis of superior qualifications and need, of twelve University Scholarships and twelve Graduate Tuition Grants. The University Scholarships provide free tuition for a full program to graduate study; the Graduate Tuition Grants are awarded to accompany certain research fellowships and provide for the remission of graduate tuition.

The William C. Gotshall Scholarships

A bequest from the late William C. Gotshall provides funds for six scholarships to be awarded annually to worthy graduate students in any branch of engineering offered at Lehigh University. Appointment is for one year, with an annual stipend of \$1000.00. Recipients of these awards pay the regular tuition fees. No duties other than graduate study are required of the holders.

Research Fellowships

Graduates in appropriate curricula of colleges, universities, and technical schools whose requirements for graduation are substantially the same as those at Lehigh University are eligible to apply for appointment to any of the following research fellowships, as

available, except the Student Chemistry Foundation Fellowship, which may be awarded only to a graduate of Lehigh University.

Appointment to these fellowships is for a period of two semesters and may be renewed, provided the work of the holder is of such quality as to justify the continuation of financial aid. Holders of the fellowships devote half their time to graduate study, and the other half to research work in the department to which they are assigned.

Graduate fellows pay the regular tuition fees. However, the committee on graduate scholarships and fellowships, in awarding a fellowship, may award at the same time a graduate tuition grant. The grant provides remission of all tuition fees during the period for which it is awarded.

A holder of a fellowship may not accept any employment for pay without the written permission of the Dean of the Graduate School.

Candidates for fellowships must make application on blanks provided by the University on or before March 1. Requests for application blanks should be addressed to: Office of Admissions, Lehigh University, Bethlehem, Pa.

New Jersey Zinc Company Research Fellowship

The New Jersey Zinc Company provided funds in 1924 for a research fellowship to be known as the New Jersey Zinc Company Research Fellowship. Half of the time of the holder of this fellowship must be devoted to research work in the department to which he is assigned; the other half to graduate study leading to a master's degree.

The Henry Marison Byllesby Memorial Research Fellowships

In 1926 Mrs. H. M. Byllesby, widow of Col. H. M. Byllesby, M.E. '78, President of the Byllesby Engineering and Management Corporation, provided an endowment fund for the establishment of the Henry Marison Byllesby Memorial Research Fellowship in Engineering. Holders of these fellowships must devote half of their time to research work on some problem in electrical, mechanical, or hydraulic engineering, proposed by the president of the Byllesby Engineering and Management Corporation and approved by the Lehigh Institute of Research; the other half to

graduate study leading to the degree of Master of Science. At the present time two awards can be made each year.

**The James Ward Packard Research Fellowships in Electrical
or Mechanical Engineering**

The income from a bequest from James Ward Packard, M.E., '84, provides for a research fellowship in any field in which Lehigh University offers work for the doctorate.

The C. Kemble Baldwin Research Fellowships in Aeronautics

A fund established by Mrs. C. Kemble Baldwin as a memorial to her husband, C. Kemble Baldwin, M.E., '95, provides for the appointment of a research fellow in any branch of science having a bearing on the field of aeronautics. One or occasionally two appointments are available each year.

**The Lawrence Calvin Brink Research Fellowship
in Civil Engineering**

A fund established by the late Mrs. L. C. Brink as a memorial to her husband, Lawrence Calvin Brink, C.E., '94, provides for the occasional appointment of a research fellow in civil engineering.

The Student Chemistry Foundation Fellowship

In the spring of 1927, members of the class of 1930 established the Student Chemistry Foundation in honor of Harry Maas Ullmann, A. B., Ph.D., a member of the chemistry department from 1894 to 1938 and head of the department from 1912 until his retirement. Subsequent classes have contributed to this fund, which now provides an annual research fellowship in chemistry or chemical engineering. Only Lehigh graduates are eligible for this fellowship.

**The Garrett Linderman Hoppes Research Fellowship
in Civil Engineering**

A fund established by the late Mrs. Maria Hoppes in memory of her son, the late Garrett Linderman Hoppes, C.E., '83, provides for the occasional appointment of a research fellow in civil engineering.

The William L. Heim Research Fellowship in Chemistry

A research fellowship in chemistry was established by William L. Heim, B.S. in Chem., '02.

**The Roy R. Horner Research Fellowship in Metallurgy
and Inorganic Chemistry**

The income from a bequest by Roy R. Hornor, B. S., '99, provides for a research fellowship in either metallurgy or inorganic chemistry. While the appointment generally will be made alternately between the metallurgy department and the chemistry department, it may be determined by the qualifications of available candidates.

The Katherine Comstock Thorne Fellowship in Biology

The late Gordon Comstock Thorne of the class of 1916 endowed, in memory of his mother, a fellowship in biology, to be known as the Katherine Comstock Thorne Fellowship.

Charles W. Parkhurst Research Fellowship

A fund established by Mrs. Mary Tudor Parkhurst to perpetuate the memory of her husband, a member of the Class of 1893. The income is used to provide a research fellowship in any field, as determined by the Board of Trustees.

ADDITIONAL FELLOWSHIPS

Certain fellowships are supported annually by various foundations, learned societies, and industrial organizations. For the most part these fellowships are reserved for applicants well along in the work towards the doctorate. Ordinarily the fellow devotes full time to academic work and receives a stipend ranging from \$1200.00 to \$2400.00 plus freedom from tuition fees. Appointments are made for the academic year.

The following are currently available:

The DuPont Company Fellowship in Mechanical Engineering.

The DuPont Company Fellowship in Metallurgical Engineering.

The Howard Flint Fellowship in Chemistry (for research relating to printing ink).

The George Gowen Hood Fellowship (supported by the Catherwood Foundation) in any field leading to the Doctorate.

The Linde Air Products Company Fellowship in Metallurgy.

The Pure Oil Company Fellowship in Chemistry.

The Francis McD. Sinclair Fellowship in Chemistry (for research relating to printing ink).

The Socony-Vacuum Company Fellowship in Analytical Chemistry.

The Weirton Steel Company Graduate Fellowship in Chemistry or Chemical Engineering.

The Westinghouse Fellowship in Mechanical Engineering.

ENDOWMENT OF FELLOWSHIPS

Research fellowships named in honor of an individual or a corporation offering opportunities for graduate work and training in research in any designated field of study may be established in perpetuity through the payment to the Board of Trustees of \$30,000.00. The income from this fund will be paid to the holder of the fellowship after the deduction of his tuition and laboratory fees. If the donor of funds for the establishment of a fellowship provides that the holder devote half his time as a research assistant in the Institute of Research, the remaining time to be devoted to graduate study, the University will remit the tuition fee and make only such charges against the fund as are necessary to cover the cost of materials, supplies, and apparatus that need to be provided for the work of the fellow.

PRIZES

The Wilbur Scholarship Prize

The Wilbur Scholarship was founded in 1872 by Elisha P. Wilbur, Trustee of Lehigh University from 1871 until his death in 1910, the University's first treasurer, and also twice Secretary of the Board. It provides the sum of \$200.00 which is awarded annually to the sophomore with the best record for the sophomore year.

The Elisha P. Wilbur Prizes

A fund was established by the late E. P. Wilbur for distribution in prizes as the faculty might determine. The income from this fund beyond that necessary to award the Wilbur Scholarship Prize is used to provide awards as follows:

Wilbur Mathematics Prizes:

A first prize of \$50.00 to be awarded annually to the highest ranking freshman engineer in the first year of freshman engineering mathematics completed at Lehigh University, as recommended by the Department of Mathematics.

A second prize of \$25.00 to be awarded annually to the second highest ranking freshman engineer in the first year of freshman engineering mathematics completed at Lehigh University, as recommended by the Department of Mathematics.

The John B. Carson Prize

An annual prize of \$50.00 was established by Mrs. Helen Carson Turner, of Philadelphia, Pennsylvania, in memory of her father, John B. Carson, whose son, James D. Carson, was a graduate of the civil engineering curriculum of Lehigh University in 1876. It is awarded to that senior in civil engineering who shows the most marked excellence in the professional courses of his curriculum.

The William H. Chandler Prizes in Chemistry

Four annual prizes of \$25.00 each, one in each class, for excellence in the chemistry and chemical engineering curricula were established by Mrs. Mary E. Chandler, of Bethlehem, Pennsylvania, widow of Dr. William H. Chandler who was professor of chemistry at Lehigh University from 1871 until his death in 1906. In memory of Dr. Chandler the faculty named the prizes the William H. Chandler Prizes in Chemistry.

The Cornelius Prize

The Cornelius Prize of \$25.00, established by Wm. A. Cornelius, M.E., '89, and maintained by his widow, Mrs. Eleanor R. W. Cornelius, since his death in 1947, will be awarded annually to the senior student in mechanical engineering who is judged to have profited most by his opportunities at Lehigh University. The award will be based 70 per cent on scholarship, 20 per cent on attainment in general culture, and 10 per cent on development in personality. To be eligible for the award, a student's scholastic standing must be in the top quarter of the class in the College of Engineering.

The Electrical Engineering Prize

An annual prize of \$25.00, established by an anonymous graduate of the curriculum in electrical engineering, is awarded to the member of the sophomore class in electrical engineering having made the best record in the work of the sophomore year.

The Philip Francis duPont Memorial Prize in Electrical Engineering

The Philip F. duPont Memorial Prize Fund was established in 1929 by L. S. Horner, E.E., '98. The annual income of this fund is awarded each year in the way of prizes, two-thirds to the highest ranking senior and one-third to the second highest ranking senior in electrical engineering.

The Harold J. Horn Prizes

The heirs of Harold J. Horn, E.E., '98, established a fund, the income of which is used in the award of a first and second prize of \$40.00 and \$20.00 respectively for the two highest ranking juniors in electrical engineering.

Alumni Prizes

Funds are provided by the Alumni Association for the annual award of four prizes of \$25.00 each. Two prizes are awarded to the highest ranking juniors in the College of Engineering, one to the highest ranking junior in the College of Arts and Science, and one to the highest ranking junior in the College of Business Administration.

The Williams Prizes in English

The late Professor Edward H. Williams, Jr., an alumnus of the University of the class of 1875, established prizes for excellence in English composition and public speaking. The freshman, sophomore, and junior prizes are awarded by the faculty on the recommendation of the department of English.

FRESHMAN COMPOSITION PRIZES. A first prize of \$75.00, a second prize of \$50.00, and a third prize of \$25.00 are awarded annually for the three best compositions submitted by freshmen of regular standing as required work in their English courses.

PRIZES

SOPHOMORE COMPOSITION PRIZES. A first prize of \$75.00, a second prize of \$50.00, and a third prize of \$25.00 are awarded annually for the three best compositions submitted by sophomores of regular standing as required work in their English courses.

JUNIOR COMPOSITION PRIZES. A first prize of \$75.00, a second prize of \$50.00, and a third prize of \$25.00 are awarded for the three best essays submitted by juniors as part of the required work in their courses in English.

The Williams Senior Prizes

The Williams Senior Prizes are awarded by the faculty on the recommendation of the committee on Williams Senior Prizes.

1. First prizes of \$150.00, second prizes of \$100.00, and third prizes of \$50.00 are awarded annually in each of the five fields of economics, English, philosophy, psychology, and history and government for dissertations submitted by regular members of the Senior class on or before April 15.

2. The committee on Williams Senior Prizes publishes, before the close of the academic year, a list of recommended subjects for dissertations; but a senior may submit a dissertation upon any other subject in the respective field if the subject has received the approval of the committee.

3. Each senior entering the competition shall submit to the committee his choice of subject and plan of work by November 15.

4. The awards are made by the faculty upon recommendation of the committee, but no award is made if in any case a dissertation does not meet the standards of merit established by the committee. This standard includes such points as excellence in thought, plan, development, argument, and composition.

The Williams Prizes in Intramural Debating

Sums totalling \$250.00 are awarded annually as prizes in intramural debating. Students engaged in this activity are organized under the direction of the department of English into teams, which compete as units in a series of debates held throughout the year. The sum of \$150.00 is divided equally between the two members of the winning team, the sum of \$100.00 between the two members of the runner-up. Winners of first prizes may not compete in the next year.

The Williams Prizes in Extempore Speaking

A first prize of \$75.00 and a second prize of \$50.00 are awarded to freshmen of regular standing who excel in a contest in extempore speaking held in May of each year.

A first prize of \$75.00, a second prize of \$50.00, and a third prize of \$25.00 are awarded annually to the winners in a contest in extempore speaking for sophomores, juniors, and seniors. Winners of first prizes are not eligible to compete in subsequent years.

The Allen S. Quier Prize in Metallurgy

An annual prize of \$15.00 has been provided by the daughters of the late Allen S. Quier in memory of their father, to be awarded to the senior who is adjudged by the staff of the department of metallurgical engineering to have made the most progress in his work in that curriculum. While high scholastic standing is a requisite, the prize is awarded on the basis of progressive achievement in scholastic work, rather than an average rating.

The Pennsylvania Institute of Certified Public Accountants Prize

The Pennsylvania Institute of Certified Public Accountants awards each year an Accountants' Handbook to the senior in the College of Business Administration majoring in accounting who is outstanding in academic achievement and leadership.

The Elizabeth Major Nevius Award

The Elizabeth Major Nevius Award was established by Walter I. Nevius, E.E. 1912, "in loving memory of his wife, who profoundly admired young men of diligence, intelligence, aggressiveness and sterling character." The award of \$500 shall be made annually to that senior enrolled in any five year combination curriculum leading to two baccalaureate degrees who, upon completion of his first four years at Lehigh University and upon graduation with his class, shall be adjudged the most outstanding of the seniors completing work for their first baccalaureate degree and continuing to a second baccalaureate degree at Lehigh University, judged upon the basis of leadership, citizenship, and scholarship.

The Choral Cup

THE CHORAL CUP. The Choral Cup provided by Richard K. Burr, I.E. 1953, John D. Kirkpatrick, Bus. Adm. 1955, Donald E. Richert, Bus. Adm. 1953, and Norman I. Stotz, Jr., Arts 1952 is awarded to the outstanding senior participating in the vocal organizations of the Department of Music.

PRIZES

The Concert Cup

THE CONCERT CUP. The Concert Cup provided by Richard K. Burr, I.E. 1953, John D. Kirkpatrick, Bus. Adm. 1955, Donald E. Richert, Bus. Adm. 1953, and Norman I. Stotz, Jr., Arts 1952 is awarded to the outstanding senior participating in the instrumental organizations of the Department of Music.

The Shields Cup

THE SHIELDS CUP. The Shields Cup, provided by Dr. Robert Shields, former director of music at Lehigh, is awarded each year to that student who is considered most outstanding in overall musical activities.

American Society For Testing Materials Student Membership Prize

AMERICAN SOCIETY FOR TESTING MATERIALS STUDENT MEMBERSHIP PRIZE. The American Society for Testing Materials awards each year four student memberships to students who in their junior year have demonstrated interest and meritorious work in the engineering courses which are related to the American Society for Testing Materials.

The McClain Progress Award

THE MCCLAIN PROGRESS AWARD. The McClain Progress Award, consisting of a trophy and a fifteen (\$15.00) dollar purchase prize, and provided by Mr. A. V. McClain, shall be tendered that student whose progress in painting in the Department of Fine Arts Studio classes during the year shall be most marked.

The McClain Award For Meritorious Painting

THE MCCLAIN AWARD FOR MERITORIOUS PAINTING. The Award, consisting of a trophy and a fifteen (\$15.00) dollar purchase prize, and provided by Mr. A. V. McClain, shall be tendered the student of painting in the Department of Fine Arts Studio classes who completes the most meritorious painting during the academic year.

Scholarship Cups

PHI SIGMA KAPPA SCHOLARSHIP CUP. A scholarship cup, to be awarded for one year to the fraternity in the interfraternity council having the highest scholastic average for the preceding year and to become the permanent property of the fraternity winning it for three successive years, was provided by an alumnus of

the Nu Chapter of Phi Sigma Kappa social fraternity in 1923. This cup was retired upon presentation to the Tau Delta Phi fraternity on Founder's Day, 1947, the winning group having had the highest scholastic average among those eligible for the prize for three successive years.

A new cup, to be known also as the Phi Sigma Kappa Scholarship Cup and to be awarded on the same terms as the original, has been provided by the local chapter of Phi Sigma Kappa.

TRUSTEE'S SCHOLARSHIP CUP. The trustees of the University have provided a scholarship cup which is awarded for one year to the living group having the highest scholarship average for the preceding year. The trustees' scholarship cup becomes the permanent property of any living group winning it for three successive years.

Prizes Awarded by Student Organizations

TAU BETA PI PRIZE. The Tau Beta Pi honorary engineering fraternity awards each year a slide rule or other prize of equivalent value to the engineering freshman having the highest scholastic average.

ETA SIGMA PHI PRIZE. The Eta Sigma Phi classical fraternity awards a cash prize of \$10.00 to that student doing the best work in sophomore collegiate Latin.

PI TAU SIGMA PRIZES. The Pi Tau Sigma honorary fraternity in mechanical and industrial engineering awards each year a mechanical engineers' handbook to the highest ranking freshman in the curricula in mechanical engineering and industrial engineering respectively.

ETA KAPPA NU PRIZE. The Eta Kappa Nu honorary fraternity in electrical engineering awards a handbook in electrical engineering to the highest ranking freshman in the curriculum in electrical engineering.

AMERICAN SOCIETY OF CIVIL ENGINEERS PRIZE. The Lehigh Valley Section of the American Society of Civil Engineers offers a prize of a junior membership in the American Society of Civil Engineers to the outstanding senior in civil engineering holding membership in the student chapter.

PRIZES

AMERICAN SOCIETY OF MECHANICAL ENGINEERS JUNIOR MEMBERSHIP PRIZE. The Anthracite-Lehigh Valley Section of the American Society of Mechanical Engineers awards annually a prize of the value of \$10.00 to an outstanding member of the Lehigh Student Branch of the ASME. This prize takes the form of junior membership for one year in the parent society.

AMERICAN CHEMICAL SOCIETY AWARD. The Lehigh Valley Section of the American Chemical Society awards a membership in the American Chemical Society and a subscription to a journal of this society to the highest ranking junior in chemistry or chemical engineering.

ALPHA A. DIEFENDERFER AWARD. In recognition of Professor Emeritus Alpha Albert Diefenderfer's long service as faculty adviser to the organization, the Lehigh University Chemical Society established in 1947 the Alpha A. Diefenderfer Award for the highest ranking sophomore in analytical chemistry. Each winner is presented with an engraved certificate, and his name is inscribed on a plaque given by the Society and displayed in the Chemistry Building.

ALPHA KAPPA PSI KEY. The Alpha Sigma Chapter of Alpha Kappa Psi, a professional fraternity in commerce, awards annually the Alpha Kappa Psi Scholarship Key to the senior student pursuing a degree in the College of Business Administration, who has attained the highest scholastic average for three years of collegiate work at Lehigh University.

CHI EPSILON PRIZE. The Chi Epsilon national honorary fraternity in civil engineering offers annually, a prize to the highest ranking freshman in Civil Engineering. The prize will consist of a Civil Engineering Handbook to be selected by the Fraternity.

PHI ETA SIGMA AWARD. The Lehigh Chapter of this National freshman honor society for men offers an award to the Residence Halls Section with the highest freshman average for the preceding year. The trophy is a gift from Professor of Chemistry Harold V. Anderson.

Summer Sessions

The courses offered during the 1954 Summer Session were arranged as follows: (1) two undergraduate sessions of six weeks each from June 22 through July 31 and from August 2 through September 11; (2) the regular graduate session of six weeks, June 22 through July 31; (3) the post-session, August 2 through August 17, designed primarily for graduate students; (4) the workshops, June 22 through July 10 or July 24, consisting of programs in the fields of elementary education and guidance exclusively for teachers; (5) the special engineering courses and camps including civil engineering, June 13 through July 3 and July 6, through July 24, mechanical engineering, June 21 through July 10, July 12 through July 31, and August 2 through August 21, and mining engineering, June 13 through June 26 and (6) the reading and study clinic, August 16 through September 3, designed primarily for students who are planning to enter college.

The *Summer Session Announcement*, containing a full description of courses to be offered in 1955 together with information concerning admissions, fees, etc., will be sent on request addressed to the director of the Summer Session.

General College Division

The General College Division, plans for which were approved by the faculty on April 6, 1942, was organized to supplement the work of the established undergraduate curricula by meeting the educational needs of certain special groups of students. The Division aims to provide an opportunity for young men not planning a four year program to pursue such work, either of a general or a more specialized nature, as their preparation and interests make desirable; a trial period for those who wish to become candidates for baccalaureate degrees but whose preparatory training does not fully satisfy the entrance requirements for the curricula of their choice; and facilities for qualified male adults to continue their education without being committed to a restricted or specialized program.

Although all work available through the General College Division will be found at present among the regular offerings of the

several departments, the work taken by students enrolled in this division is not regarded as primarily preparation for admission to the upper classes of the University; rather, the courses are looked upon as complete in themselves. As time indicates certain needs not recognized at the moment, consideration will be given to the development of special courses for the General College Division group.

Each student in the General College Division has an individual program, one not subject to distribution or curriculum requirements, yet one limited by the student's ability to meet the prerequisites of the courses which he desires to take. With but few exceptions, the student enrolled in this division enjoys the same privileges as all other undergraduates in the University, including eligibility to unrestricted prizes, access to student aid, and the right of petition; and he is also subject to the same general regulations, those pertaining to scholastic probation not accepted. The General College Division student will not, however, be a candidate for a degree, save in those instances where transfer to one of the undergraduate programs of study leading to degrees is approved by a committee composed of directors of curricula.

Adult Education Program

The Adult Education Program is committed to serving the needs and interests of people in all walks of life. It is limited to courses offered in the afternoon, evening, and Saturday sessions, but is open alike to men and women students of twenty-one years of age and older.

A wide variety of courses is included in the present program. Some are intended to meet specific needs of special groups. Others attempt to serve the general public in such fields as art, literature, history, government, and international relations. Still others result from cooperative arrangements with business and industry, and with service and welfare agencies.

The Adult Education Program, approved by the faculty on March 6, 1944, is a recognition of the principle that social institutions have service responsibilities within their spheres of influence. As a private educational institution, Lehigh University's interest is as great but its area of operation properly more restricted than

that of a publicly supported institution of higher learning. It is the desire of the University to meet the increasing demand for this new service through a flexible program closely adjusted to individual needs and interests.

University Library

The overall pattern of Library service at Lehigh conforms to that in most academic institutions; the maintenance of a sound collection coupled with a maximum of utility.

The general and special collections number some 330,000 volumes with annual accessions at the rate of about 7,000 volumes. The Library currently receives some 1400 serials and periodicals, and is a depository for a wide selection of U.S. Government Documents. In a real sense this is a Reference Library. But apart from the General Collections, the specialized Reference Collection, embodying all the basic dictionaries, encyclopedias, indexes and professional handbooks, is readily available to students.

We regard the Library as a sort of mechanical memory whose use can be taught and learned. For this reason, we employ the so-called "open-stack" system in which the whole of the general collection is freely accessible to all students. Fundamental concepts of library use and the techniques of literature search are formally taught to upperclassmen in certain curricula by members of the Library staff. In addition, the professional staff is prepared to give assistance at any time to students who may have some particular question or difficulty.

For a statement of the regulations governing the services of the Library the student is referred to the *Library Handbook* available at the Loan Desk.

Religious Observances

On each Sunday of the academic year chapel services are held at 11:00 A.M. in Packer Memorial Church, with the chaplain of the University in charge. Outstanding leaders of the Christian Church fill the pulpit approximately once a month. Music for these

Sunday services is furnished by the Lehigh University Chapel Choir. In addition, Holy Communion services are held every Sunday at 10:00 A.M.

There are also a number of special religious observances, such as the Chapel Service and Convocation which opens Freshmen Week, the All-University Chapel Service and Convocation, which marks the official opening of the academic year; the annual Christmas Vesper Choral Program; the observance of the World Student Christian Federation Day of Prayer with other schools in the area; and the annual All-University Memorial Observance in May.

Attendance at all religious services is voluntary.

Students' Health Service

The Students' Health Service of Lehigh University consists of an ambulatory Dispensary. We have no Infirmary. Office hours are from 8:30 A.M. to 6:00 P.M. daily through the Fall and Spring semesters, except Saturdays and Sundays. Saturday hours are from 8:30 A.M. to 12:30 P.M., and Sundays from 10:00 A.M. to 12:00 noon. Through the Summer semester no Sunday hours are held. Within these hours the Health Service staff is available for consultation and treatment.

In the event of injury or illness outside regular Dispensary hours the service of a local physician should be obtained. Such physicians' fees will be paid by the student, his family, or by his Health Insurance Plan; not by the Health Service. Any physician of choice may be consulted. However, a partial list of physicians' names, addresses, and phone numbers is distributed at the beginning of the Fall Semester for posting in each student living group. Due to limited Staff and multiplicity of Dispensary duties, Health Service physicians are not able to make professional calls on students in living groups, or in rooms. If unable to visit the Dispensary in the event of illness or injury, students are advised to call in a local physician for treatment. Again, such physicians' fees will be paid by the student, his family, or his Health Insurance Plan.

Ambulatory Dispensary Services

Medical and minor surgical problems of students are dealt with by the Dispensary. The Dispensary is not responsible for the care

of any chronic illness, or any illness or injury contracted or sustained while away from the University, excepting on official trips. A necessarily limited courtesy service is also extended by the Health Service to those faculty members and other employees who wish to avail themselves of it.

Physical Examinations

As a part of routine admission procedure, each prospective new or transfer student, prior to his arrival on campus, must submit a Record of Physical Examination completed and signed by his own physician. Concurrently, each prospective student will also complete a Health History Form as a part of the same admission routine. Appropriate forms will be provided by the University Health Service to all applicants for admission prior to their arrival on campus when possible, and are to be returned in completed form to the Director of the Health Service within the time limit specified. All undergraduate students who are registered as taking 7 credit hours or more per semester are responsible for completion of the regular Record of Physical Examination and Health History forms.

Late, or non-return of these forms results in incompleteness of our Records, and necessitates special handling in order to bring them to completion. Therefore, a fine of \$10.00 is charged all students whose completed form(s) are not returned within the time specified. In addition, any further delay in completion and delivery to the Health Service of these forms after arrival on campus, following personal notification of such deficiency by the Health Service, will result in an additional fine of \$10.00 for each successive failure to comply. Please note also that a fine of \$10.00 will be levied for each default against any student who fails to respond to an official summons from the Health Service; or who fails to appear for a regularly and officially scheduled Health Service procedure in which he is involved.

All new employees are expected to have a physical examination before beginning their duties at the University. Such pre-employment examinations may be done by the Health Service Staff, or by the applicant's chosen physician (at the applicant's expense) on Health Service forms supplied for that purpose. All completed forms are to be returned to the Director of the Health Service as soon as possible for confidential analysis and filing.

The physicians of the Health Service carefully analyze the results of all physical examinations in order to detect any latent or obvious physical, emotional, or mental abnormality. When found, the person involved may be invited in for a conference, and his disability discussed with him confidentially.

Close cooperation between the Department of Physical Education and the Health Service permits the establishment of rehabilitation measures, etc., as indicated, for students. All students are graded for the Physical Education program according to their respective abilities to participate in physical activities.

In addition, students who are unable to meet the physical requirements for participation in the Reserve Officers' Training Corps program are disqualified from that unit by the Health Service.

Tuberculosis Survey

A 70 mm Chest X-ray is made of each incoming student routinely. Any departure from the normal noted during the reading of these films calls for a 14"x17" chest X-ray and further investigation. An endeavor is made to have at least two such X-rays completed on each student during his attendance at the University.

Immunizations

In accordance with University regulations, all new and transfer students are required either to show evidence of recent vaccination against smallpox, or to submit to such vaccination prior to the beginning of classes.

In addition, protection against triple typhoid, tetanus, influenza A and B, and various allergies are offered when and as indicated, at the student's expense.

Neuropsychiatric Services

Assistance is offered to students who have personal and confidential problems that interfere to a greater or lesser degree with their school work. Emotional conflicts, neuroses, anxiety states, etc., complicated by difficult curricula frequently cause trouble for many, who, by virtue of an early unsatisfactory personal background or adjustment, are unable to cope with their problems.

The Health Service is a part of the University's Student Counseling Service. Its contribution to this Service consists of establishing, insofar as possible, the mental, emotional and physical status of any referred student's health situation.

Laboratory

All procedures are accomplished by a Registered Laboratory Technician here at Lehigh. In addition to usual routines, accessory laboratory facilities, also help lend considerable authority to diagnostic efforts.

X-ray Services

The present X-ray equipment of the Health Service includes a regular X-ray unit, a 70 mm Chest X-ray unit, and necessary developing and drying apparatus. Our X-ray services are limited to bone and chest films. No X-rays are taken of any body organs which involve the use of dyes, barium, etc., for their discovery.

To other than students, a small charge is made to cover the cost of material used.

Physiotherapy

A well-equipped physiotherapy section is a valuable adjunct to any University Health Service. Our own is better than adequate now, with increased facilities scheduled for a new Health Service building, this Service should be among the best.

Personnel

Full-time Health Service personnel normally includes two Physicians: the Director, and the Assistant Director; a Physiotherapist, a Laboratory and X-ray Technician, two Nurses, a Secretary, a Business Manager, and a Record Clerk. Part-time personnel includes the intercollegiate teams' Surgeon, a First-aid Assistant and a student assistant.

Health and Accident Insurance

The University offers students a choice between two kinds of insurance policies against illness and/or injury. One kind of policy covers for both illness and accident, and the other for accident only. The latter policy, of course, costs less. Both kinds are offered for a very nominal fee, and on an entirely voluntary basis.

The Health Service recommends highly these insurance plans to both present and prospective students. Much experience has emphasized the importance of such protection, and we urge all students to participate in one or the other of these plans throughout their entire college careers.

Students who, in the judgement of the administrative officers of the University, are not in a position to meet the costs of illness or accident necessitating professional and hospital care, shall be required to take out both health and accident insurance.

Placement, Counseling and Reading Services

In order to prepare the student for the exigencies of college life, the University maintains a placement, counseling, testing and reading service. This service functions to help the student make satisfactory adjustments to his college environment, to help improve reading and study habits, and to provide counseling and aid in obtaining a job while in school or upon graduation.

Counseling and Testing Services

The primary aim of counseling is to aid the student in gaining a better understanding of himself so that he may have a basis for more satisfactory adjustments.

Many normal individuals fail to achieve genuine satisfaction and true success because they are blocked by lack of knowledge of their abilities and aptitudes, inadequate vocational information or inability to make personal and social adjustments.

There is available a well-developed library of occupational and educational materials and a variety of interest, achievement, personality, aptitude, and ability tests for the use of the student in self-appraisal. Counselors confer with those seeking guidance, interpreting test results and helping the student to analyze his capacities so he can better make his own decisions as to his future course of action. Every student in the University is privileged to avail himself of this counseling and testing service without cost.

Another service is the administration of many group testing programs throughout the year. In addition to the Freshman Week testing program there are offered the Graduate Record Examination, Law School Admissions Test, Medical College Admissions Test, National Teacher Examinations, Selective Service College Qualification Test, Accounting Orientation Test and others.

One of the important functions of the Service is the undertaking

of research and study dealing with tests, counseling, and other personal problems.

Reading and Study Services

There are many factors which influence the performance of college students. An important one is the expertness with which they master the skills necessary for college work. High level skills are needed in: preparing assignments, note-taking, outlining, listening, recalling information and facts, taking examinations, preparing written and oral reports and reading critically and accurately. Most students entering college have some proficiency in these skills, but is it enough?

The Reading and Study Services offer Lehigh men an opportunity to develop satisfactory reading and study habits. The following services are available to all students:

- . . . Analysis of reading and study skills
- . . . Reading and study improvement programs
- . . . Individual guidance on problems of academic adjustment

We encourage first year students, particularly, to arrange for a conference with one of our counselors. We assist them in making an evaluation of their learning tools and in planning for more effective work.

The improvement programs are offered periodically during the fall and spring semesters. Small group instruction is scheduled for interested students three hours a week for six consecutive weeks. The instruction is adapted to the needs of the individual in well equipped classrooms.

Placement Services

Assistance is given to seniors seeking positions, underclassmen who need part-time jobs and alumni looking for employment or a change of positions.

This office places particular emphasis upon the techniques of job seeking and interviewing. A well developed vocational material file is maintained. Descriptive literature concerning many different companies is also available.

During the college year representatives of many industries and business houses visit the campus to recruit our graduates.

Academic Observances

Baccalaureate Sunday

Baccalaureate Services were held on Sunday afternoon, June 20, 1954 in Packer Memorial Church. The sermon was delivered by Dr. Robert J. McCracken, pastor of the Riverside Church, New York, N. Y.

University Day

University Day was observed Monday, June 21, 1954. Commencement exercises were held in Eugene Gifford Grace Hall. The address to the graduating class was delivered by Monroe J. Rathbone, president of the Standard Oil Company of New Jersey. Honorary degrees and degrees in course were conferred, commissions in the Regular Army of The United States, the Regular United States Air Force and the Officers' Reserve Corps were awarded, and graduation honors and prizes won by members of the graduating class were announced.

Founder's Day

The annual exercises in honor of the founder of the University were held Sunday afternoon, October 10, 1954 in the Packer Memorial Church. The address was delivered by Dr. Hubert M. Poteat, professor of Latin at Wake Forest College. Degrees were conferred; and graduation honors, class honors and prizes were announced.

Alumni Association

The Alumni Association, which has been in existence since 1876, was incorporated in 1917 under the name of the Alumni Association of the Lehigh University, Inc. The offices of the association are located in the Alumni Memorial Building. Along with the regular alumni activities, the association is largely concerned with fund raising to meet the needs of the University.

The officers of the Alumni Association for 1954-55 are:

President, J. Porter Langfitt, '21, Chicago, Ill.

Vice President, Ralph L. Wilson, '21, Canton, Ohio.

Vice President, S. Murray Rust, Jr., '34, Pittsburgh, Pa.

Treasurer, H. P. McFadden, '25, Bethlehem, Pa.

Archivist, Arthur W. Klein, '99, Bethlehem, Pa.

Executive Secretary and Editor of the *Lehigh Alumni Bulletin*,
Robert A. Harrier, '27, Pen Argyl, Pa.

Over fifteen thousand Lehigh alumni throughout the country who maintain an active interest in the University are afforded opportunities for frequent social contact with Lehigh men of all classes through the various alumni clubs established in areas of alumni concentration. Important outposts of the University, these clubs hold meetings and carry on activities that mirror the activities of the University in its cultural, social, financial and recreational phases.

The following are the alumni clubs: New York Lehigh Club, Philadelphia Lehigh Club, Pittsburgh Lehigh Club, Chicago Lehigh Club, Washington, D. C. Lehigh Club, Detroit Lehigh Club, Northeastern Pennsylvania Lehigh Club (Scranton and Wilkes-Barre, Pa.), Maryland Lehigh Club (Baltimore, Md.), Youngstown (Ohio) Lehigh Club, Lehigh Club of New England (Boston, Mass.), Lehigh Club of Central Pennsylvania (Harrisburg, Pa.), Lehigh Club of Northern New York (Schenectady, N.Y.), Lehigh Club of Central New York (Rome, N.Y.), Lehigh Club of Northern Ohio (Cleveland, Ohio), Lehigh Club of Southern New England (Hartford, Conn.), Lehigh Club of Western New York (Buffalo, N.Y.), Lehigh Home Club (Bethlehem, Pa.), Lehigh Club of Southeastern Pennsylvania (Reading, Pa.), Lehigh Club of Central Jersey (Trenton, N. J.), Lehigh Club of York-Lancaster (Pa.), Lehigh Club of Northern New Jersey (Newark), Lehigh Club of Northern California (San Francisco), Lehigh Club of Southern California (Los Angeles), Lehigh Club of Delaware (Wilmington), Lehigh Club of Monmouth County, N. J., South Jersey Lehigh Club (Camden), Bergen-Passaic Lehigh Club (Glen Rock, N.J.), Central Ohio Lehigh Club, Twin-City Lehigh Club (Minneapolis, Minn.), Lehigh Club of St. Louis (St. Louis, Mo.), Lehigh Club of Milwaukee, (Wisc.), Lehigh Club of Rochester (N.Y.), Lehigh Club of Atlanta (Ga.), Watchung Area Lehigh Club (Plainfield, N.J.).

Organizations

Honorary Scholarship Societies

PHI BETA KAPPA. Students in the College of Arts and Science and the College of Business Administration who, up to the middle of the senior year, maintain high scholarship may be elected to membership; also a limited number of engineering students whose work in philosophical, scientific, and language studies is of high grade.

TAU BETA PI. This national honorary society, which now has seventy-one chapters, was founded at Lehigh University in 1885 by Professor E. H. Williams, Jr. Students in the College of Engineering may be elected to membership during their junior and senior years if they have maintained high scholarship.

SIGMA XI. Election to membership is based upon the completion of original and noteworthy research in pure or applied science and the publication of the results thereof. Ordinarily undergraduates are eligible to associate membership only, their election being based upon their promise of achievements in scientific research.

PHI ETA SIGMA. To be initiated into this national freshman honor society the freshman must make a minimum 3.5 average during his first semester or his first two semesters at the University.

Other Honorary Scholarship Societies

- ALPHA EPSILON DELTA (pre-medical)
- BETA GAMMA SIGMA (business administration)
- ETA KAPPA NU (electrical engineering)
- ETA SIGMA PHI (classics)
- NEWTONIAN SOCIETY (freshman mathematics)
- PHI ALPHA THETA (history)
- PI GAMMA MU (social science)
- PI MU EPSILON (mathematics)
- PI TAU SIGMA (mechanical engineering)

Course Societies

Intellectual interest in various fields of study and professional spirit among arts, business, and engineering students is promoted by a group of organizations commonly called course societies. The

first of these organizations historically was the Chemical Society, established in 1871. The list now includes:

In Arts and Science

Circulo de Espanol
Delta Omicron Theta (debating)
Der deutsche Verein
International Relations Club
Robert W. Blake Society (philosophy)
Robert W. Hall Pre-Medical Society

In Business Administration

Alpha Kappa Psi (professional fraternity in business administration)
Lambda Mu Sigma (marketing)
Lehigh Accounting Society
Lehigh Business Society

In Engineering

Alpha Pi Mu (industrial engineering)
American Chemical Society (chapter of student affiliates)
American Institute of Chemical Engineers (student chapter)
American Institute of Electrical Engineers (student branch)
American Institute of Industrial Engineers (student branch)
American Institute of Physics (student section)
American Society of Civil Engineers (student branch)
American Society of Mechanical Engineers (student branch)
Howard Eckfeldt Society (student branch of the American Institute of Mining and Metallurgical Engineers)
Institute of Radio Engineers (student branch)
Metallurgical Society
Student Chemical Society

Other Student Organizations

Alpha Chi Epsilon (Episcopal pre-theological honorary society)
Alpha Lambda Omega (Allentown group)
Alpha Phi Omega (national service scouting fraternity)
Arcadia, the Student Council
Arnold Air Society (Cheli Squadron)
Band
Bridge Club

ORGANIZATIONS

Brown Key Society
Camera Club
Canterbury Club
Chapel Choir
Chess Club
Chi Epsilon (Civil Engineering)
Christian Council
Christian Fellowship
Combined Musical Clubs (Glee Club, Cliff Clefs, Collegians,
Symphony Orchestra, Brass Choir)
Conservation Club
Cosmopolitan Club
Cut and Thrust Society (fencing)
Cyanide Club (junior honorary society)
DeMolay Club
Ernest W. Brown Astronomical Society
Flying Club
Hillel Society
Interfaith Council
Interfraternity Council
Lutheran Student Fellowship
Model Railroad Club
Motor Club
Music Festival
Mustard and Cheese (dramatic club)
National Society of Pershing Rifles
Newman Club
Omicron Delta Kappa (senior honorary fraternity)
Pi Delta Epsilon (honorary journalistic fraternity)
Political Science Assembly
Radio Society
Residence Halls Council
Roger Williams Fellowship
Sailing Club
Scabbard and Blade (honorary military fraternity)
Shop Club
Skiing Club
Society of American Military Engineers
Town Council
Varsity "L" Club

Wesley Fellowship

Westminster Fellowship

The following Greek letter national social fraternities have chapters at Lehigh University: Alpha Chi Rho, Alpha Sigma Phi, Alpha Tau Omega, Beta Theta Pi, Chi Phi, Chi Psi, Delta Chi, Delta Phi, Delta Sigma Phi, Delta Tau Delta, Delta Upsilon, Kappa Alpha, Kappa Sigma, Lambda Chi Alpha, Phi Delta Theta, Phi Gamma Delta, Phi Sigma Kappa, Pi Kappa Alpha, Pi Lambda Phi, Psi Upsilon, Sigma Alpha Mu, Sigma Chi, Sigma Nu, Sigma Phi, Sigma Phi Epsilon, Tau Delta Phi, Theta Chi, Theta Delta Chi, Theta Kappa Phi, Theta Xi.

Student Publications and Radio

The students of Lehigh University publish a semi-weekly college newspaper, *The Lehigh Brown and White* and a year book, *The Epitome*. The students' modern radio station, WLRN, 640 kc, has a broadcast day of sixteen hours. The *Radio Workshop* which broadcasts weekly programs over local commercial stations provides practical experience for students taking certain courses in the division of speech.

Lehigh Institute of Research

The Lehigh Institute of Research was organized in 1924 to encourage and promote scientific research and scholarly achievement in every division of learning represented in the organization of the University, and in recognition of the need for further and more exact knowledge in science and in the application of science to the affairs of modern life. The Institute was reorganized in 1945 in order to cooperate more effectively with industry and government agencies.

The purposes of the Institute of Research include the training of men for research work, the publication of results of investigations, the conduct of general research, the conduct of cooperative research, and advisory service.

Detailed information concerning the organization and regulations of the Institute of Research will be provided by the Director upon request.

INDUSTRIAL RESEARCH APPOINTMENTS

Lehigh University cooperates with industrial concerns, technical associations and government agencies in carrying on basic research and applied research designed to develop new and to improve old products and methods of production. Cooperative research projects usually provide every year a number of research assistantships which are available to qualified graduate students. These assistantships provide stipends which vary from \$100 to \$180 per month, depending upon the qualifications of the appointee and the time assigned to the project. Appointments are for one year and may be renewed or extended. Part- or full-time employment on research projects is frequently available during the summer, and whenever possible it is desirable for entering students who hold research appointments to begin their employment in June or July before the commencement or formal graduate study in the fall. Applications for research assistantships should be accompanied by evidence of the candidate's qualifications for the appointment sought and sent to the Director of the Lehigh Institute of Research or to the head of the department concerned.

Among the cooperative research programs in progress at present are those sponsored by the following agencies:

Various departments of the United States
 Government, Army and Navy
 American Cyanamid and Chemical Company
 Mutual Chemical Company of America
 Armstrong Cork Company
 Bethlehem Steel Company
 William S. Merrell Company
 Nopco Chemical Company
 National Lead Company
 Westvaco Chlorine Products Division
 Kentile, Incorporated
 S. B. Foot Tanning Company
 Pfister and Vogel Tanning Company
 National Printing Ink Research Institute
 Pressure Vessel Research Committee
 Welding Research Council
 Pennsylvania Department of Highways
 Troy Engine and Machine Company

E. R. Squibb and Sons
Radio Corporation of America
Enthone, Incorporated
Diamond Alkali Company
A. F. Gallun & Sons Company
The Ohio Leather Company
Fred Rueping Foundation Inc.
A. Trostel & Sons Company
Purolator Products, Inc.
Rodale Manufacturing Company Inc.
E. Bilhuber, Inc.
Edgar Brothers Company
Quaker Oats Company
Reheis Co., Inc.

Bureau of Educational Service

The Bureau of Educational Service was organized in 1953 to coordinate the many educational services rendered by the University to public and private schools and to provide further professional assistance to schools and school groups.

Among its purposes are the rendering of professional assistance to educational agencies in the cooperative study of their problems, the fostering of educational research, and the making more readily available the educational research facilities of the University. In fulfilling its purposes, the services of specialists—local, state, and national—in the several fields of education, both subject matter and professional, are made available.

Detailed information concerning the organization and operation of the Bureau will be provided by the Director upon request.

Buildings and Grounds

The University occupies twenty-six buildings which are located on a tract of land covering one hundred eighty acres on the north side of South Mountain, overlooking the valley of the Lehigh River and the City of Bethlehem. In addition, the University has an athletic field, seven and one-half acres in area with field house, gymnasium, and covered grandstand, located about a mile from the University campus.

Packer Hall

Packer Hall is a four-story sandstone building, 215 feet long and 60 feet wide.

The department of civil engineering occupies the greater part of the first and second floors. The drawing rooms, surveying instrument room, structural models and soils mechanics laboratories are located here, the balance of the laboratories being in Fritz Engineering Laboratory.

The department of mathematics and astronomy, philosophy and psychology also are located in this building. The psychology laboratory has the standard equipment for the several courses in experimental psychology and for research.

The Chemistry Building

The Chemistry Building is a three-story fire-proof sandstone edifice, 259 feet long and 44 feet wide, with a wing 62 feet long and 42 feet wide, and with a three-story extension, 60 feet long and 37 feet wide. An additional three-story wing, 116 feet long by 52 feet wide, has been added to the east of the original building.

Laboratory space and equipment are provided for qualitative and quantitative analysis, inorganic chemistry, organic chemistry, sanitary chemistry, industrial biochemistry, colloid chemistry, X-ray analysis, gas analysis, the furnace assay of ores, industrial chemistry, chemical engineering, and research in chemistry and chemical engineering.

The trustees of the University named this building, exclusive of the new east wing, the William H. Chandler Chemistry Laboratory in recognition of Dr. Chandler's thirty-five years' service as professor of chemistry, 1871-1906. The east wing was named the Harry M. Ullmann Chemistry Laboratory, in recognition of Dr. Ullmann's service as head of the chemistry department.

The Physics Building

The Physics Building is a four-story sandstone structure, 240 feet long and 44 to 56 feet wide. This building is devoted entirely to the department of physics. In addition to offices, recitation rooms, and lecture rooms, there are fully equipped laboratory rooms for undergraduate and graduate classes, a number of smaller laboratories for research, a reading room, machine shop, wood-working shop, glass-blowing room, constant-temperature rooms,

storage battery room, sound-proof room, and dark rooms. The building is equipped throughout with water, gas, compressed air, and electric power outlets.

The W. A. Wilbur Engineering Laboratory and Power House

The W. A. Wilbur Engineering Lab and Power House is a two story sandstone building, 188 feet long and 44 feet wide.

The Power plant contains four Babcock and Wilcox straight-tube cross-drum boilers, each rated at 300 boiler horse-power, two coxe chain grate stokers, two turbine driven Sturtevant blowers and coal-, water-, and ash-handling equipment of modern design. Two boilers are equipped with Petro oil burners and fully automatic controlled. A third boiler has been equipped with a B. & W. oil burner also fully automatic controlled. Four 15,000 gal. fuel oil storage tanks are installed at convenient locations for receiving oil supply.

The plant is designed and equipped to provide steam at 250 pounds pressure to the engineering laboratories, in addition to heating the University buildings. It is so arranged that any boiler can be isolated for laboratory tests for long periods if necessary. From this plant a six inch line carries steam to the Packard Laboratory at the pressure desired for the laboratory work. Modern safety appliances and measuring equipment have been incorporated.

A coal-storage yard has room for two months' supply of coal and a system of belt-conveyors and bucket-elevators is provided for receiving coal, dumping it on the storage pile, and conveying it into the boiler room as needed.

Williams Hall

Williams Hall, the donation of Dr. Edward H. Williams, Jr., of the class of 1875, was so named by the trustees of the University in recognition not only of this gift but also of Dr. Williams' long continued and important service to the University as professor of mining and geology.

Williams Hall is a three-story brick building, 186 feet long and 70 feet wide. It contains the offices, class rooms, laboratories, departmental libraries, and museum collections of the departments of biology, geology, and metallurgical engineering.

Vivarium

The Vivarium is a three-story concrete and brick surface building 35 feet long and 25 feet wide, with a green house on the upper floor. A bridge passage connects the third floor of the Vivarium with the second floor of Williams Hall.

Vivarium Addition

The new Bioelectrical Laboratory Addition, better known as the J. L. Pratt Research Laboratory is a one-story brick and concrete block building 35 feet long and 21 feet wide located on the south end of the building.

The Fritz Engineering Laboratory

A major addition to historic Fritz Engineering Laboratory is now nearing completion. The new structure, together with the original building, gives the department of civil engineering one of the outstanding laboratories in the country for instruction, research, and industrial testing.

The late John Fritz of Bethlehem, known as the father of the steel industry in the United States, and a member of the University's first board of trustees, gave the University funds for the erection and equipment of the original laboratory, which measured 114 by 92 feet in plan. The building, which was designed and erected under the personal supervision of Mr. Fritz, has been used by the department for various research and industrial projects and for laboratory instruction in mechanics of materials and hydraulics.

The new addition, composed of a seven-story section 130 feet by 70 feet in plan and a four-story section 114 by 24 feet in plan, will house the world's largest universal hydraulic testing machine. This machine is capable of applying a 5,000,000 lb. load to tension or compression members up to 40 feet in length and flexure specimens up to 100 feet long. Equipment for applying repeated loads to structures, the latest strain and deformation measuring instruments, and impact and hardness testing machines are available.

A floor-controlled twenty-ton capacity crane, seventy feet above floor level, services the new south bay and the 5,000,000 lb. testing machine. A ten-ton crane serves the north bay with its 800,000 lb. machine, 2,000,000 inch-pound torsion machine and other machines of smaller capacity.

Research and student instructional laboratories in hydraulics, soil mechanics, concrete, structural models and sanitary engineering, as well as a separate student laboratory for materials testing, are provided.

The concrete laboratory includes storage bins for aggregates, together with equipment for making and storing all types of plain, reinforced, and prestressed concrete specimens.

The hydraulics laboratory has three levels, with pumps, tanks, turbines, weirs, and other appropriate apparatus used both for student instruction and industrial tests. Space is available for model tests of spillways, rivers, channels, etc.

The laboratory machine shop is completely equipped with lathes, millers, drill-presses, grinders, power saws, and miscellaneous tools and equipment. The welding shop provides facilities for both electric arc and gas welding.

Other facilities include photoelastic stress analysis equipment, a photographic darkroom, research library, staff offices, seminar rooms and a conference room.

The Eckley B. Coxe Mining Laboratory

The Eckley B. Coxe Mining Laboratory is a two-story sandstone building, 100 feet long and 75 feet wide. It is occupied exclusively by the department of mining engineering.

The building contains the offices of the department of mining engineering, a reception room, a drafting room, a locker and wash room, a laboratory equipped for fuel research, a balance room, and a shop.

On the basement floor are two air compressors, rock drills, and a motor-generator set. The upper main floor has one section for crushing, grinding, and the preparation of samples, and for making sieving tests. The remainder of this floor is equipped with units for elementary and advanced laboratory work in ore dressing and coal preparation—ball mills, a rod mill, classifiers, jigs, concentrating tables, flotation machines, magnetic separators, and a Chance coal cleaner, together with auxiliary equipment such as float-and-sink apparatus, ore-dressing microscope, etc.

The lower second floor is equipped as a laboratory for the necessary analytical work in connection with ore dressing and coal preparation, and as a fuel technology laboratory for coal, gas and

oil analysis. Part of the upper second floor is used as a departmental drafting room in connection with the course in mine surveying and mining methods; the remaining portion is being equipped as a mine ventilation laboratory.

The laboratory was named by the trustees of the University in memory of Eckley B. Coxe, who was a pioneer and a leader in the profession of mining engineering in this country, and an active friend and valued trustee of the University from its early days until his death.

Christmas-Saucon Hall

Christmas-Saucon Hall is a three-story stucco building. It contains the office of the College of Business Administration, the offices, lecture rooms, and recitation rooms of the departments of English, accounting, economics and sociology, and finance, University Counseling Center and the Director of Placement. Christmas Hall has historic interest as the first building of Lehigh University.

Coppee Hall

Coppee Hall is the headquarters of the College of Arts and Science. It contains the offices of the College of Arts and Science, a lecture room, and the offices and recitation rooms of the departments of German, Latin, Greek, romance languages, history and government, international relations, and fine arts.

Sayre Observatory

The Sayre Observatory was the gift of the late Robert H. Sayre, one of the original trustees of the University.

The observatory contains an equatorial telescope of six inches clear aperture and of eight feet focus, by Elvin Clark, a zenith telescope of four and one-half inches clear aperture, an astronomical clock by William Bond & Son; a meridian circle; a prismatic sextant by Pistor and Martins; an engineer's transit and a sextant by Buff and Buff. Students in practical astronomy receive instruction in the use of the instruments and in observation.

The land upon which the observatory stands, consisting of seven acres adjoining the original grant, was presented to the University by the late Charles Brodhead, of Bethlehem.

The Packer Memorial Church

The Packer Memorial Church, in which religious services are

held, was the gift of the late Mrs. Mary Packer Cummings, daughter of the founder of the University. It was built in 1887. Occasional musical recitals and the annual Bach Festival are held in this building which now contains the Starkey Memorial Organ.

The University Library

The University Library is a five-story building of native stone, with limestone trim, in the collegiate Gothic style of architecture. It incorporates the original library building, erected in 1877 by Asa Packer and named in memory of his daughter, Lucy Packer Linderman, and a completely modern edifice built in 1929 with funds contributed by alumni.

The main floor of the new portion of the building is occupied by the general reading room with its two alcoves, offices of the library staff, and the lobby, where are located the loan desk, card catalogue, and serial indexes. On the upper floors of this portion of the building are eleven seminar rooms, the Treasure Room, the Lehigh Collection, and the Lehigh Art Gallery. On the ground floor is the Browsing Room, a large pleasant room furnished with easy chairs and an assorted collection of books, where students may read in an atmosphere of relaxation. It also houses the scores, records, and phonograph of the College Music Set, the gift of the Carnegie foundation. The remainder of the new wing and the entire older portion of the building are occupied by stacks. In the stacks are a number of cubicles, which may be reserved by students and faculty members engaged in special work.

Eugene Gifford Grace Hall

Eugene Gifford Grace Hall, named for the donor and devoted to sports and recreation, is a stone edifice, approximately 120 feet wide and 180 feet long. The building contains a sports theater, which also serves as an assembly room for the University, with a seating capacity of about 3000, and a large drill floor, which is also available for the larger University dances and receptions. In addition, there are rooms for the band, orchestra, and athletic teams, and classrooms and offices for the departments of Air and Military Science and Tactics. Promenade terraces at the level of the dance floor on three sides of the building afford views over the Lehigh Valley and of South Mountain.

Dravo House

Dravo House, a five-story fireproof dormitory completed in April, 1948, provides accommodations for 340 students. The building was made possible by the alumni and friends of the University through their contributions to the Progress Fund. Each of the four wing structures which compose the building has its own lounge and game rooms; and the center unit has a lounge and reception room for visiting friends, in addition to a ladies' lounge. There are rooms for two, three, and four students.

The Henry Sturgis Drinker House

The Henry Sturgis Drinker House, a four-story fire-proof dormitory completed in September, 1940, provides accommodations for 194 students. It has rooms for two and three, suites for four, a spacious lounge, and a reception room for visitors.

The Henry Reese Price House

The Henry Reese Price House, named in honor of Dr. Henry Reese Price, an alumnus of the University of the class of 1870 and late president of the board of trustees, furnishes dormitory accommodations for 54 students.

The Charles Russ Richards House

The Charles Russ Richards House, which was completed in September, 1938, is a four-story fire-proof dormitory with rooms for two and three and suites for four students. In addition to bedrooms and studies accommodating a total of 217, the building contains an adequate recreation room, a spacious lounge, and two reception rooms for visiting friends.

The Charles Lewis Taylor House

The Charles Lewis Taylor House, the gift of Mr. Andrew Carnegie, is a three-story concrete dormitory with accommodations for 218 students, the majority of whom are housed in three-room suites, four to each suite. The building was named Taylor Hall by Mr. Carnegie in honor of Charles L. Taylor, his former partner in business, a graduate of the University of the class of 1876 and a trustee of the University.

Drown Memorial Hall

Drown Memorial Hall was erected by friends and alumni as a memorial to the late Thomas Messinger Drown, LL.D., president of the University from 1895 to 1904. The building is devoted to the social interests of the University family. It contains study, reading, and lounging rooms, an assembly hall, the offices of Arcadia (student governing body), the student radio station WLRN and of the college publications, and club rooms for the dramatic and musical organizations.

Alumni Memorial Building

The Alumni Memorial Building, which is used as the administration building of the University, was erected as a memorial to 1,921 Lehigh men who served in World War I and especially to the forty-six who gave their lives. The cost of erection was raised by subscription from about 1,700 alumni. The Memorial Hall contains the records of the Lehigh men who served and those who died, together with mementos of the war.

In the south wing of the building are the offices of the president, vice president, dean of students, registrar, business offices, and superintendent of buildings and grounds. The north wing contains the offices of the bursar, director of admissions, public relations, alumni association, and supply bureau.

Taylor Gymnasium and Field House

In 1913, Charles L. Taylor, E.M., '76, donated to the University the funds required for the erection of a gymnasium and field house.

These buildings were recently remodeled, re-equipped and expanded as one of the major projects of the Lehigh Progress Fund.

Taylor Gymnasium, which adjoins the athletic field, is a building 222 feet long and 73 feet wide. It has been expanded by the addition of a new swimming pool measuring 75 by 42 feet, and a new gymnasium measuring 94 by 77 feet. The new swimming pool ranges in depth from five to ten feet, and includes a large gallery for spectators, an observation room below the water line and the latest filtration equipment.

Included in the renovations of the old buildings and in the new construction are locker facilities for 2600 students, a faculty locker room, coaches' locker room, five basketball courts, boxing room,

fencing room, golf practice room, wet and dry steam rooms, and a specially designed wrestling room. Also included are a well equipped first aid room for physical education activities, corrective exercise gymnasium, modern trainer's room with latest facilities, and class and meeting rooms.

Athletic, physical education and business offices have been incorporated in the new construction. Improved heating is furnished by electric blowers.

The former entrance way has been transformed into a trophy room measuring 26 by 55 feet as a repository for athletic prizes and awards. The third floor addition known as the Samuel E. Berger Room, the gift of Mr. Samuel Erwin Berger, B.A., '89, has also been remodeled.

Taylor Field

An athletic field more than nine acres in area is provided for the accomodation of students who participate in the various outdoor sports. The stadium, located on the lower level, provides football and baseball fields, surrounded by concrete stands having a seating capacity of 12,000. New steel stands were erected in 1953 above south concrete stands providing 4,000 more seats for a total seating capacity of 16,000. A new press box, mens' and womens' toilet rooms and concession booths under steel stands were erected, and all other toilet facilities were modernized. On the upper level there is a practice field for football, baseball, lacrosse, and soccer; also a quarter-mile track and a 220-yard straight-away. During the winter months a wooden outdoor running track, twelve laps to the mile, is provided.

Lehigh Field and Field House

An additional athletic field seven and one-half acres in area, with field house, gymnasium, and covered grandstand, is located about a mile from the University campus. The field house has dressing rooms, lockers, and shower baths; the gymnasium is equipped with basketball and volley ball courts. Here are eleven tennis courts for intercollegiate and intramural tennis. This field includes a playing ground for intercollegiate soccer and a field for intramural baseball and other intramural activities.

Lamberton Hall

The first floor of this building contains the main dining hall for

student use and a private dining room, together with a complete kitchen and cafeteria counter. The second floor has a large dining room, pantry and service rooms. Storerooms and service rooms for help are located in the basement.

A portion of the basement is used by the military department as a rifle range. This portion contains two indoor rifle and pistol ranges.

**The James Ward Packard Laboratory of Electrical
and Mechanical Engineering**

The late James Ward Packard, who was graduated from Lehigh University in 1884 with the degree of mechanical engineer, the designer of the first Packard motor car and founder of the Packard Motor Car Company of Detroit, Michigan, and of the Packard Electric Company of Warren, Ohio, donated \$1,200,000.00 for the erection and equipment of an electrical and mechanical engineering laboratory, which was completed in 1929.

This building, named for the donor, is a five-story steel-framed sandstone structure 225 feet long and 180 feet wide. The lobby is finished in Italian travertine. The halls throughout the building are wainscoted with Tennessee marble. An auditorium on the first floor with a seating capacity of 622 is equipped with still- and motion-picture apparatus.

The western half of the building contains the offices, classrooms, research rooms, and laboratories of the department of electrical engineering. The main dynamo laboratory contains more than 100 generators and motors of various types. The high-tension laboratory is equipped with a 150 kv. and a 60 kv. testing transformer, a 700 kv. oscillation transformer, and a source of high direct current voltage up to 100 kv. The transients laboratory is provided with six magnetic oscillographs, two cathode-ray oscillographs, two artificial transmission lines, a surge generator, and a photographic dark room. A five-unit harmonic phase-shifting motor-generator set supplies voltage of various frequencies and wave forms for special tests. The communications laboratory has extensive equipment of high-frequency measuring apparatus, vacuum-tube circuits, speech amplifiers, and a 40/80 meter transmitter (C.W. or phone) used by the radio club. The wiring system provides for quick communication and interconnection between any two parts of the building. Transforming machinery and switchboard for the laboratory power supply are located in the basement.

The eastern half of the building houses the department of mechanical and industrial engineering, with classrooms, drawing rooms, offices, research rooms, photographic dark room, shop, instrument room and laboratories.

The main laboratory contains steam power equipment, including boilers, steam engines, turbines, condensers, heaters, pumps, etc. The equipment is arranged so that tests may be made of a complete steam power plant or tests may be made of individual components. In addition, reciprocating air compressors, a ventilating fan and a high-pressure centrifugal blower are available.

The internal combustion engine laboratory has a number of automotive-engines, both spark-ignition and compression ignition types, set up for testing with an electric dynamometer. A Cooperative Fuel Research single cylinder engine is used for investigational tests. Two two-stroke supercharged marine diesel engines are set up with a hydraulic dynamometer. A small single-cylinder diesel engine, connected to an electric generator is also available.

The instrument room has a complete supply of portable instruments. The shop has facilities for maintenance and for construction of new equipment, instruments, and models.

Courses in machine design at the graduate and undergraduate levels emphasize important experimental techniques. For work in experimental stress analysis a 60,000 lb. universal testing machine is available, along with strain gage equipment, oscilloscopes, Stresscoat and a polariscope for photoelastic investigations. For vibration and balancing studies, the equipment includes vibration velocity meters, a displacement indicator, recording vibrometer, electromagnetic torque meter and portable balancing equipment.

Sayre Park

A development of the mountainside on the University grounds was affected through the donation in 1909 of the sum of \$100,000.00 by the children of the late Robert H. Sayre, to be used in the development of Sayre Park as a memorial to their father, who was a trustee of the University from its foundation until his death in 1907.

The Arboretum

The Arboretum is a tract of about eleven acres adjoining Sayre Park. It was established by a friend of the University as a tree nursery for the purpose of furnishing illustrative specimens of

American trees and of cultivating trees and shrubs for the beautifying of the park. All of the more important species of North American trees are to be found in the Sayre Park and the Arboretum. A tract of seven acres adjoining the Arboretum has been planted with a variety of indigenous trees as an exhibition growth of tree culture.

The Health Center

The Health Center, where the Students' Health Service is housed temporarily, is a rebuilt one-story frame structure, 151 feet long and 26 feet wide. In addition to offices and rooms for the personal use of members of the staff, the building contains a main and an auxiliary dispensary, a laboratory, and X-ray room, an ultraviolet room, dark rooms, a physiotherapy room, a sterilizing room, an audiometer room, and a large waiting room.

The Education Building

The Education Building, headquarters of the department of education, is a rebuilt, temporary one-story frame structure, 76 feet long and 30 feet wide. The building has a classroom with a capacity of approximately thirty, a seminar room, and six offices.

The Ordnance Laboratory

The facilities of the Departments of Air and Military Science and Tactics, located in Eugene Gifford Grace Hall, have been augmented by a temporary one-story frame structure, 60 feet long and 25 feet wide. This building contains Army and Air Force ROTC supply storage facilities and garage space.

Temporary Dormitories

Three rebuilt quonset-type frame buildings, each 125 feet long and 21 feet wide, provide temporary study and sleeping quarters for 120 students. A one-story concrete-block boiler room has been erected to supply heat for these three buildings.

Storage Buildings

Two rebuilt steel quonset huts, 96 by 20 feet, have been secured for use as storage buildings and work shops.

Service Building

The Service Building, Headquarters of the Building and Grounds, consists of one main building, a 5-story brick structure 160 feet long by 40 feet wide and a lean-to, a one- and one-half story brick structure 160 feet long by 40 feet wide. Located at Adams and 4th Streets, 250 yards from the University Campus.

The main building is used chiefly for the storage of maintenance materials and supplies, lumber, building materials, plumbing and heating supplies and electrical supplies. A freight elevator 20 feet by 10 feet is used to handle materials to the various levels. The lean-to houses the various maintenance shops, carpenter shop, tin-smith shop, paint shop and cement masons shop, along with the materials used by the trades.

LEHIGH UNIVERSITY

SUMMARY OF STUDENT REGISTRATION

Spring 1954

Students in the University

Undergraduate Students	2413
Graduate Students	477
Adult Education Students	18
Total	2908

Students in Undergraduate Curricula

Curriculum	Seniors	Juniors	Sophomores	Freshmen	G.C.D.	Total
Arts and Science	122	91	89	60	—	362
Business Administration	155	138	169	129	—	591
Chemical Engineering	31	33	66	99	—	229
Chemistry	7	12	9	10	—	38
Civil Engineering	43	34	36	69	—	182
Electrical Engineering	33	34	71	109	—	247
Engineering Physics	14	12	17	18	—	61
Industrial Engineering	58	47	52	50	—	207
Mechanical Engineering	62	62	84	129	—	337
Metallurgical Engineering	30	26	43	20	—	119
Mining Engineering	5	3	7	9	—	24
General Science & Mathematics	—	1	—	2	—	3
General College Division	—	—	—	—	13	13
Total	560	493	644	703	13	2413

REGISTRATION STATISTICS

Summer 1954 Students in the University

Undergraduate Students	671
Graduate Students	253
Adult Education Students	10
Total	934

Fall 1954 Students in the University

Undergraduate Students	2607
Graduate Students	536
Adult Education Students	6
Total	3149

Students in Undergraduate Curricula

Curriculum	Seniors	Juniors	Sophomores	Freshmen	G.C.D.	Total
Arts and Science	98	98	76	102	—	374
Business Administration	149	164	148	131	—	592
Chemical Engineering	26	57	69	86	—	238
Chemistry	10	11	8	9	—	38
Civil Engineering	38	32	52	66	—	188
Electrical Engineering	31	54	87	100	—	272
Engineering Physics	16	23	23	19	—	81
Industrial Engineering	48	51	54	57	—	210
Mechanical Engineering	60	84	91	110	—	347
Metallurgical Engineering	27	37	36	19	—	119
Mining Engineering	6	5	11	10	—	32
Unclassified Engineers	—	—	—	99	—	99
General Science & Mathematics	—	1	2	2	—	5
General College Division	—	—	—	—	12	12
Total	509	617	657	812	12	2607

GEOGRAPHICAL DISTRIBUTION OF STUDENTS

Spring 1954

California	5	Texas	1
Connecticut	60	Virginia	11
Delaware	15	West Virginia	3
District of Columbia	8	Argentina ..	1
Florida	5	Bermuda	1
Georgia	4	Brazil	1
Illinois	5	British West Indies	1
Indiana	2	Burma	6
Kansas	1	Canada	1
Kentucky ..	2	Canal Zone	1
Maine	3	Colombia	2
Maryland	42	Cuba	1
Massachusetts	33	Dutch West Indies	3
Michigan	7	Egypt	1
Missouri	3	Greece	1
New Jersey	620	Hawaii	1
New Mexico	1	India	1
New York	494	Malaya	1
North Carolina	2	Panama	1
Ohio	26	Philippine Islands	2
Oklahoma	1	Sweden	1
Pennsylvania	1013	Union of South Africa ..	1
Rhode Island	7	Venezuela	8
Tennessee	2		

GEOGRAPHICAL DISTRIBUTION OF STUDENTS

Fall 1954

California	5	Rhode Island	5
Connecticut	73	Tennessee	5
Delaware	15	Texas	3
District of Columbia	8	Virginia	10
Florida	5	Vermont	1
Georgia	2	West Virginia	3
Illinois	6	Argentina	1
Indiana	1	Brazil	3
Kansas	1	British West Indies	1
Kentucky	2	Burma	8
Maine	3	China	1
Maryland	48	Colombia	2
Massachusetts	35	Cuba	1
Michigan	10	Greece	1
Missouri	2	Hawaii	3
Montana	1	India	1
New Hampshire	1	Japan	1
New Jersey	664	Mexico	3
New Mexico	1	Netherlands West Indies	3
New York	507	Panama	2
North Carolina	2	Puerto Rico	4
Ohio	28	Philippine Islands	1
Oklahoma	1	Venezuela	10
Pennsylvania	1113		

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